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MONTHLY

MECHANICS AND HANDICRAFT

January, 1951 • 25¢

Is Your TV Put Up Right? – p.169

How Deadly Are the Russian Jets?

PAGE 90

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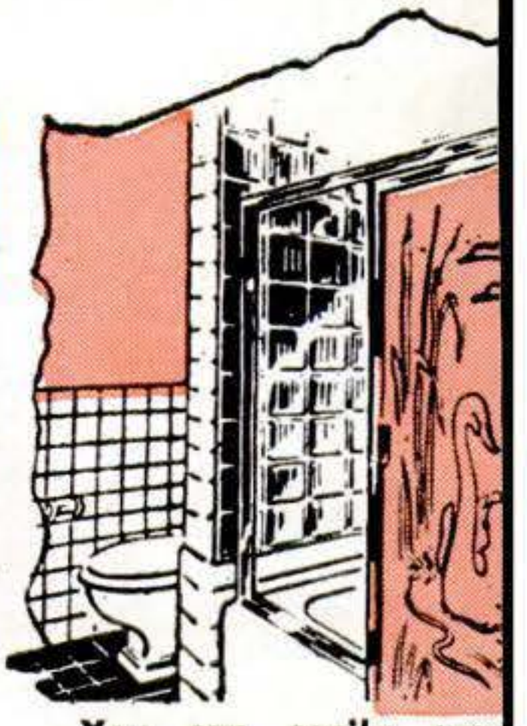

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Patterns in Bricklaying
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Partitions, Wood
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Stairs, Outdoor, Cellar
Kitchens—Plans and Designs

Joining Roof to Walls

ROOFS, INSULATION, VENTILATION, FLASHING

Installing Flashing—Diagrams, Instructions, Valleys, Chimneys, Hips, Windows, Doorways, etc.
Types of Insulation
Insulating Farm Buildings
Types of Shingles, Walls, Roofs, Hips, Ridges, etc.
How-To, How-Not-To Ideas
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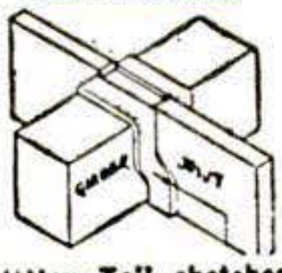

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Shelves, Cabinets
Adjusting Doors, Built-In Furniture
Bathroom Cabinets
Closets, Working Bins

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Wall Plaster Mixing
Exterior and Interior Walls
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Installing New Ceilings
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Installing Ceiling Panels

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Plumbing, Pipes of All Kinds
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Coal Bins, Construction
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Hot Water Systems
Making Woods Fire-Resistant

PAINTS, VARNISHES

Tinting
Cleaning Paint Spots
Floor Sealers
Decorating Old Floors
Color, Decorating Tips
Types of Finish—When, Where, How to Use
Whitewashing, Ingredients
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Paints for Brick, Concrete, Plaster

TOOLS, NAILS, HARDWARE

Scaffolds
Ladders, Use and Precautions
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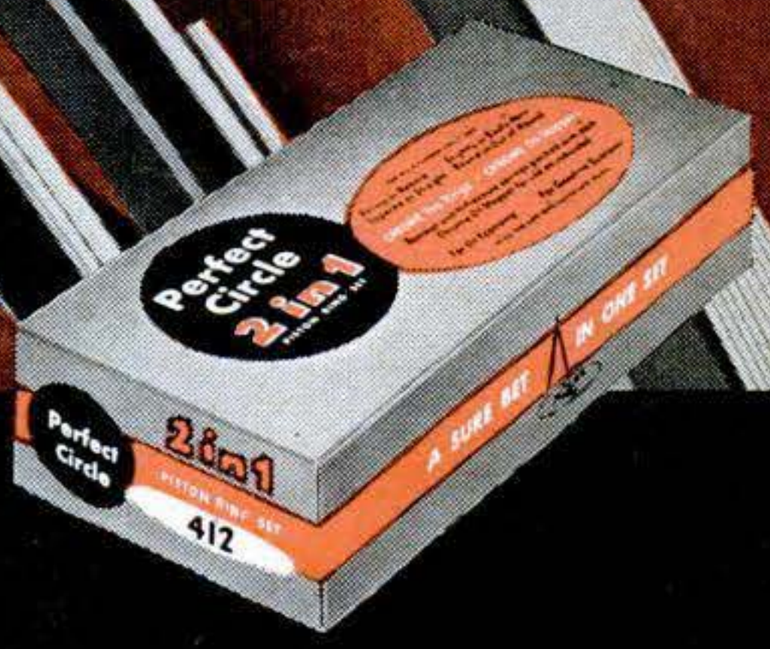

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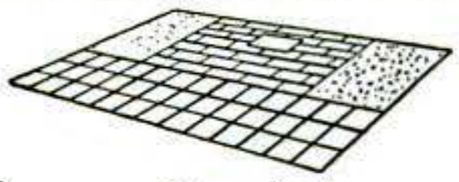

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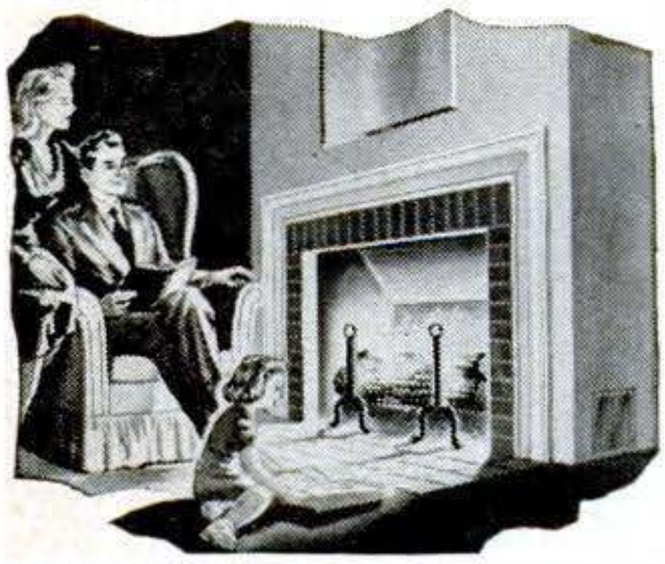

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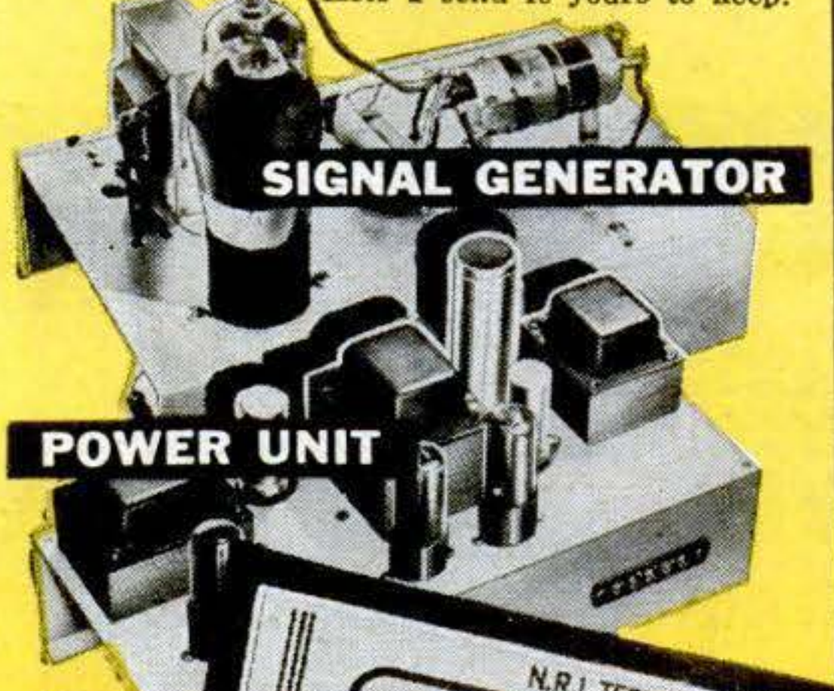

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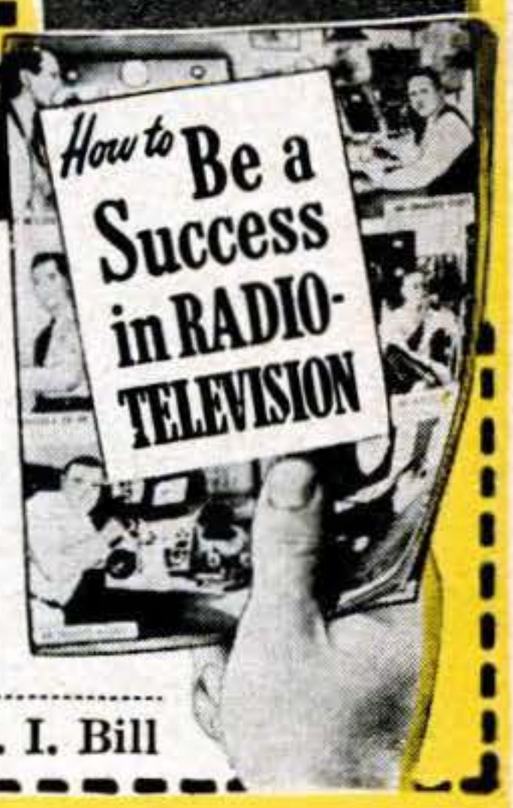

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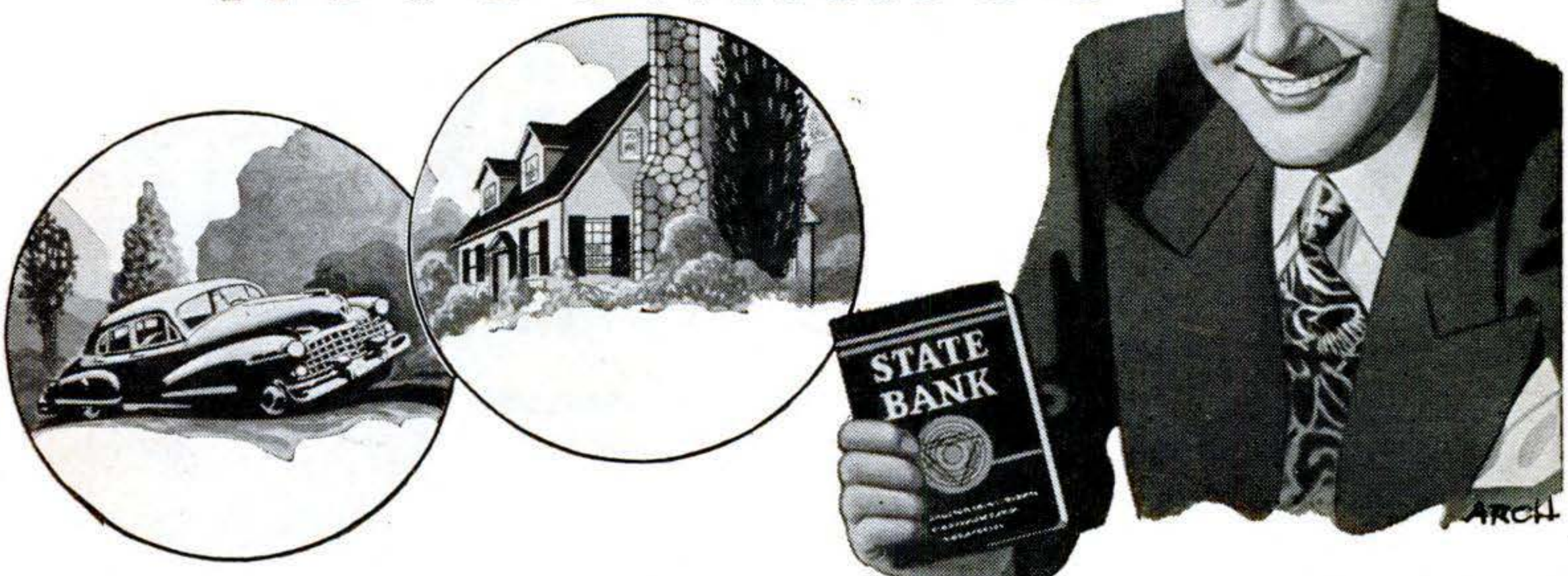

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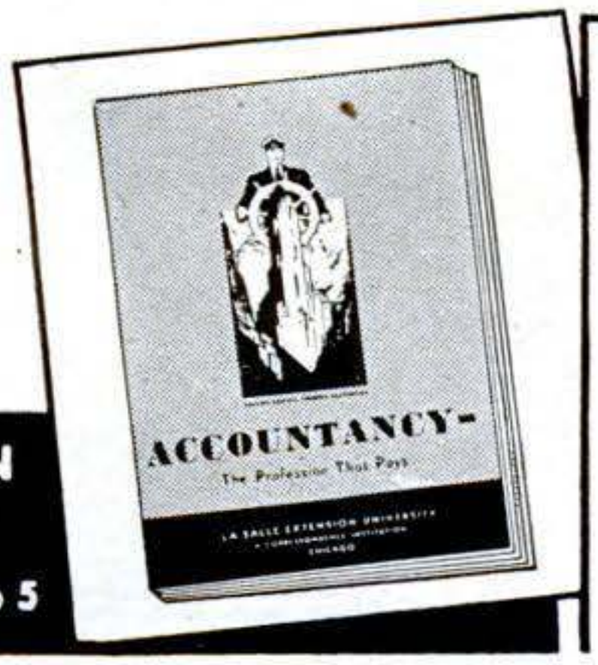

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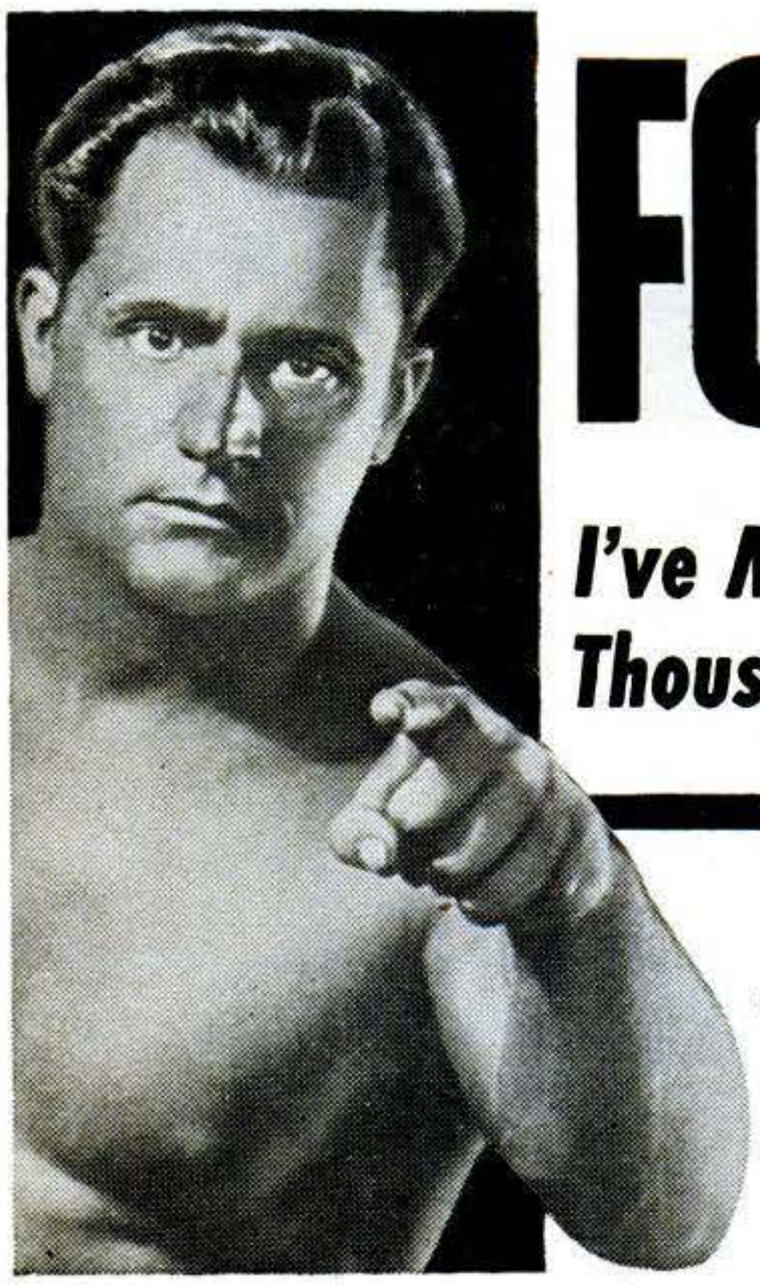

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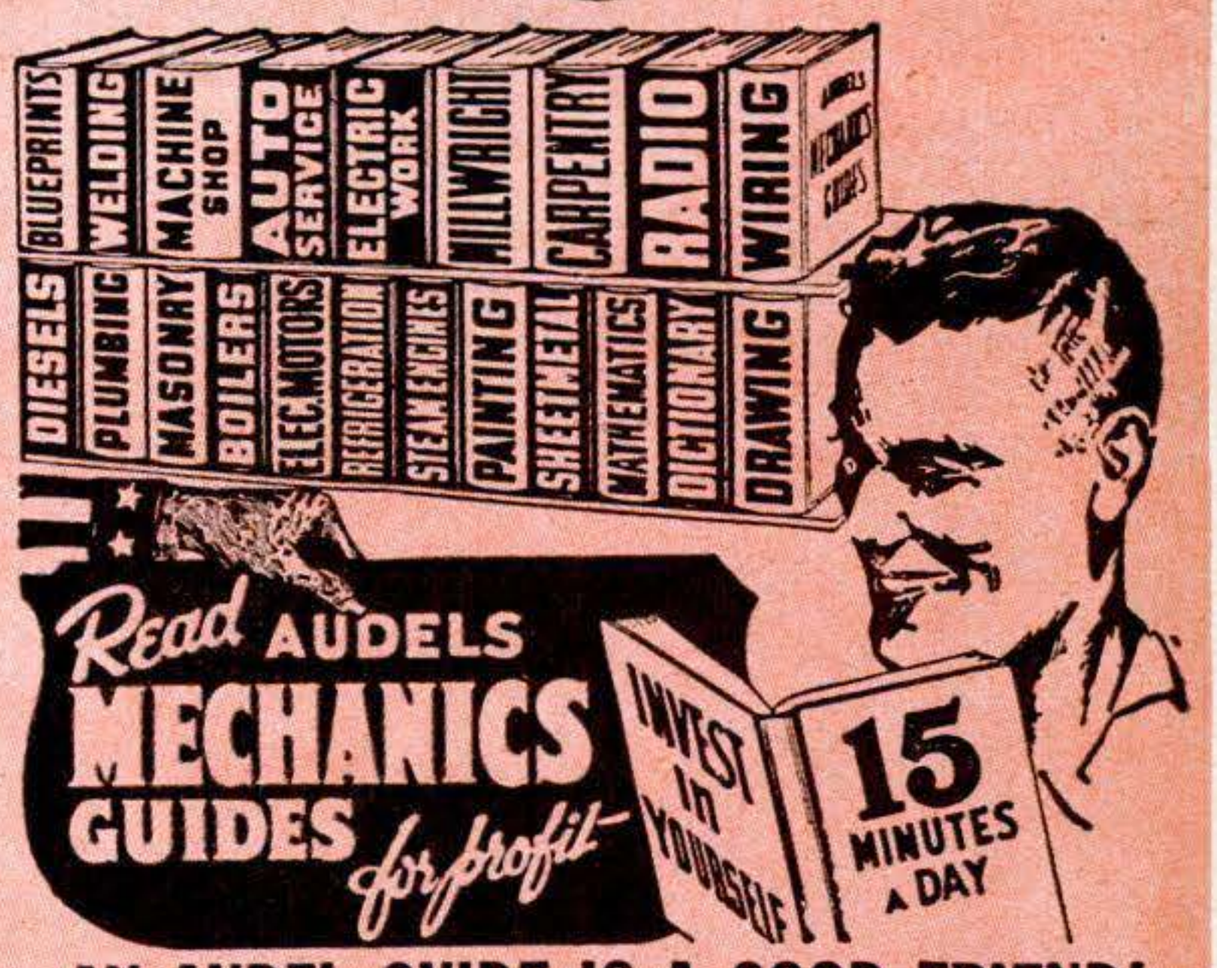

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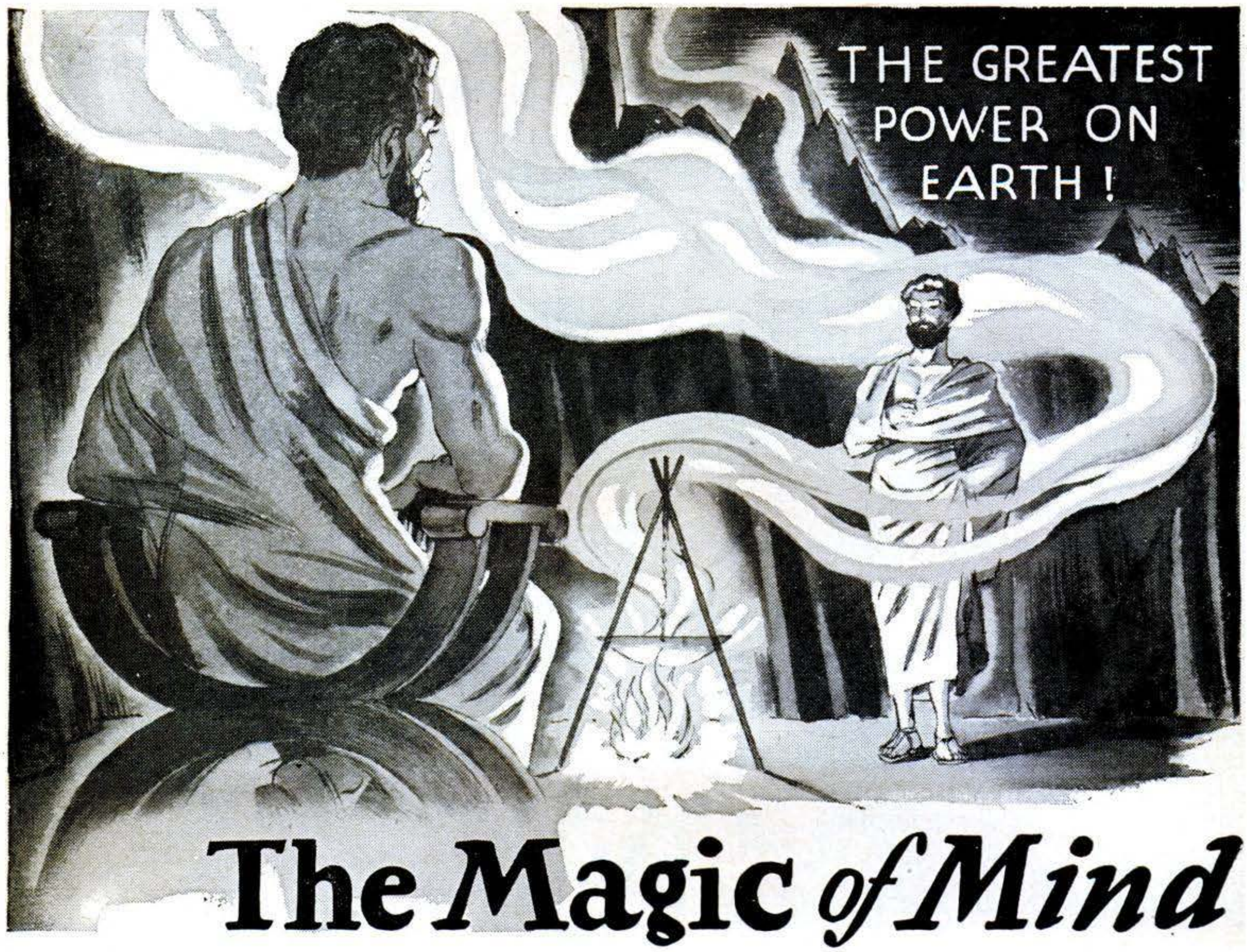

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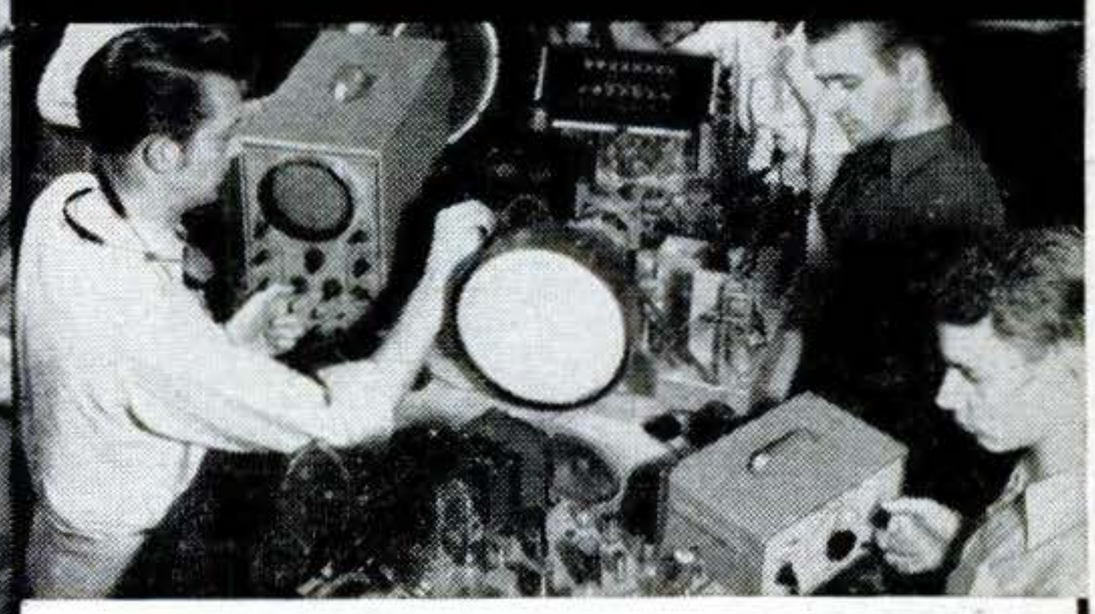

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In Defense of Racing

Sir:

To people who contend that auto racing is too dangerous, I'd like to suggest that they look closely at some of the ideas for making cars safer in your cover story last July. Most organized racing associations already require two of them: roll-over bars or frames, and seat belts.

DAVE ROBERTSON

Seattle, Wash.

More About Asphalt Tile

Sir:

Your readers might like to know something more I learned about asphalt tile since doing the flooring job I described in your November issue, page 177.

Last week we had a small oil leak in our furnace, which I didn't get around to fixing over the week end. When I did get to

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it, I found nine tile squares had been eaten through by action of the small pool of oil that had collected. The Armstrong people tell me that regular asphalt tile is badly affected by oils and greases, but that a special greaseproof asphalt tile is available for use where it might be needed.

Anyhow, your readers should know that any kind of oil spilled on ordinary asphalt-tile flooring should be wiped up immediately and thoroughly.

HENRY MORTON

Flushing, N. Y.

Hard Way to Steal a Car

Sir:

In "Hints from the Model Garage" in September, page 195, you showed a supposed way to foil car thieves by clipping a padlock through a hole drilled in the clutch-pedal arm, down close to the floorboard, so that the pedal couldn't be pushed down. It wouldn't necessarily work, and I'll bet I could drive to New York without using the clutch, to prove my point.

Here's how:

Warm up the engine with the shift in neutral. Kill engine. Start engine with shift in low—jerky, but can be done. Accelerate

to about 10 m.p.h. in low. Back off accelerator till engine floats, then shift to neutral. Slow engine further till gears match for second speed. Etc.

Right?

DON ADAMS

Cowiche, Wis.

It is indeed possible—but what thief would risk a getaway like that?

Nothing New

Sir:

In your October issue, page 174, appears an article on a table that has built-in chairs. It states that this was invented by some fellow in England. I happen to know that at

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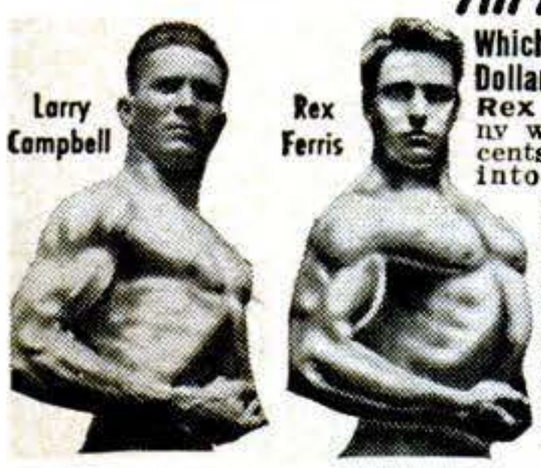

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City College of New York the tables in the cafeteria in Army Hall are built this way. They've been there for quite some time. The old saying still holds. . . .

ROBERT BARTO

The Bronx, N. Y.

Pictures Don't Lie

Sir:

The Oldsmobile sedan that you described as "brand new" in your article about roll-over tests at the GM Proving Ground [Oct., p. 173] looks like a '49 model to me.

STEPHEN GILVAR

Englewood, N. J.

Sir:

Your picture of the Olds rolling over shows its front bumper being knocked off as it hits the ground. Yet the "after" photo shows the bumper back in place. How come?

DONALD FRANCO

Saratoga Springs, N. Y.

We slipped in calling the car new: it was a '49. But that's not its bumper falling off —just part of the towing gear.

How to Stop

Sir:

As a regular reader of PS, I'd like to put to your experts a simple question on which I encounter a lot of argument. It's this: When coming to a stop in an automobile from fairly high speed, should you put on the brakes before releasing the clutch or should the clutch be disengaged and then the brakes applied?

LOUIS NEFF, JR.

Baton Rouge, La.

Among good drivers there's no argument on that one: Apply the brakes first. Do not disengage the clutch until you have almost stopped. This allows the engine to help brake the car.

Ingenuity Saves Time

Sir:

Here's a trick that other PS readers may find as useful as I have:

Occasionally you print plans for jigsaw work drawn in half size. To avoid the tedious job of redrawing them in full size, I put the plans in my enlarger just as I would

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Your disclosure should be mailed to us together with a letter authorizing us to conduct a preliminary search among previously granted U. S. patents for similar types of invention.

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with a photo. Then I adjust the enlarger for double size and make a print.

ALAN ADLER

Los Angeles

That should work if: (1) the plans are small enough to fit into the enlarger; (2) there's no heavy printing on the back.

Hybrid Engine

Sir:

It comes as a surprise to me that no one seems to have thought of coupling a turbojet with a steam turbine to make a more efficient engine. This would utilize the expanding burning gases to drive the compressor stage and the heat of the exhaust—now wasted—to generate steam for the power stage, which would be a steam turbine.

FRANK S. PYNE

Christchurch, New Zealand

Marble Trick

Sir:

Burning the oxygen out of a partly empty bottle of photo developer to prevent oxidation, as suggested in your October issue [p. 233], seems like the long way around a simple problem. Hasn't your contributor ever heard of just dropping glass marbles into containers of darkroom solutions to keep the fluid level up to the top and exclude air?

H. ABSHER

Ottawa, Ill.

Water Softeners

Sir:

Two questions on your October story about water softeners:

1: Isn't there a mixup in the caption under the sketch of the homemade softener on page 223? Seems to me that valves 1 and 3 should be opened for softening; valves 2 and 4, for regeneration.

2. Will softening the water affect it for drinking?

DONALD MCNAIR

Delia, Alberta, Canada

1. You're right—we were wrong.

2. Softening the water doesn't make much difference in taste; it changes the composition of only the hard-water chemicals—a few parts in a million parts of water.

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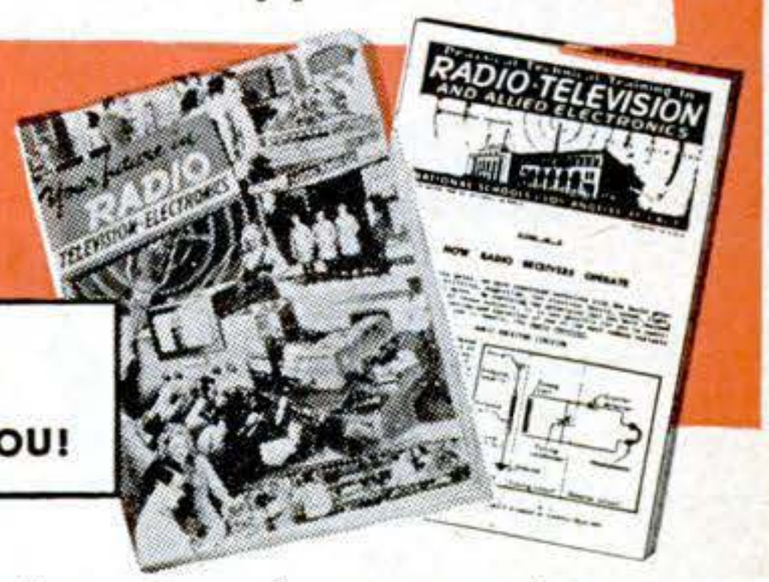

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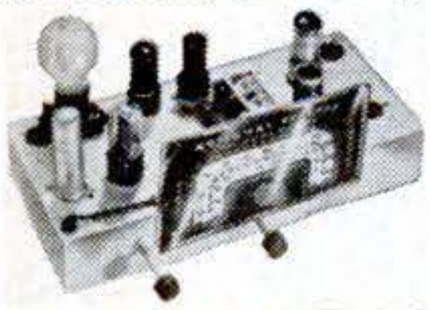

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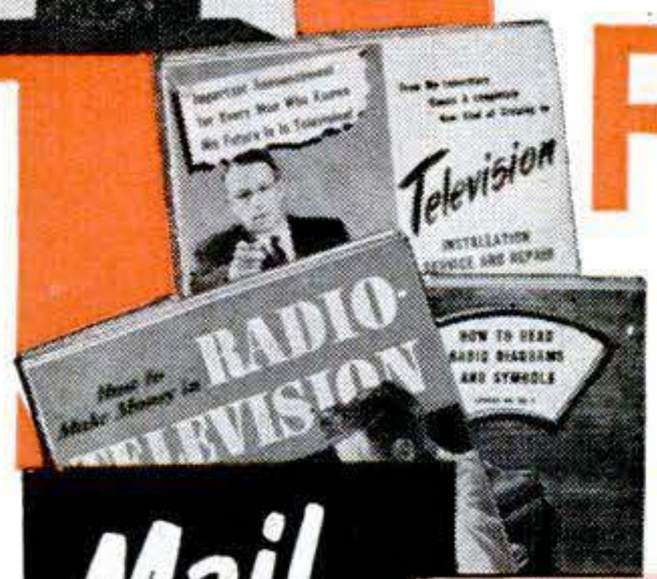

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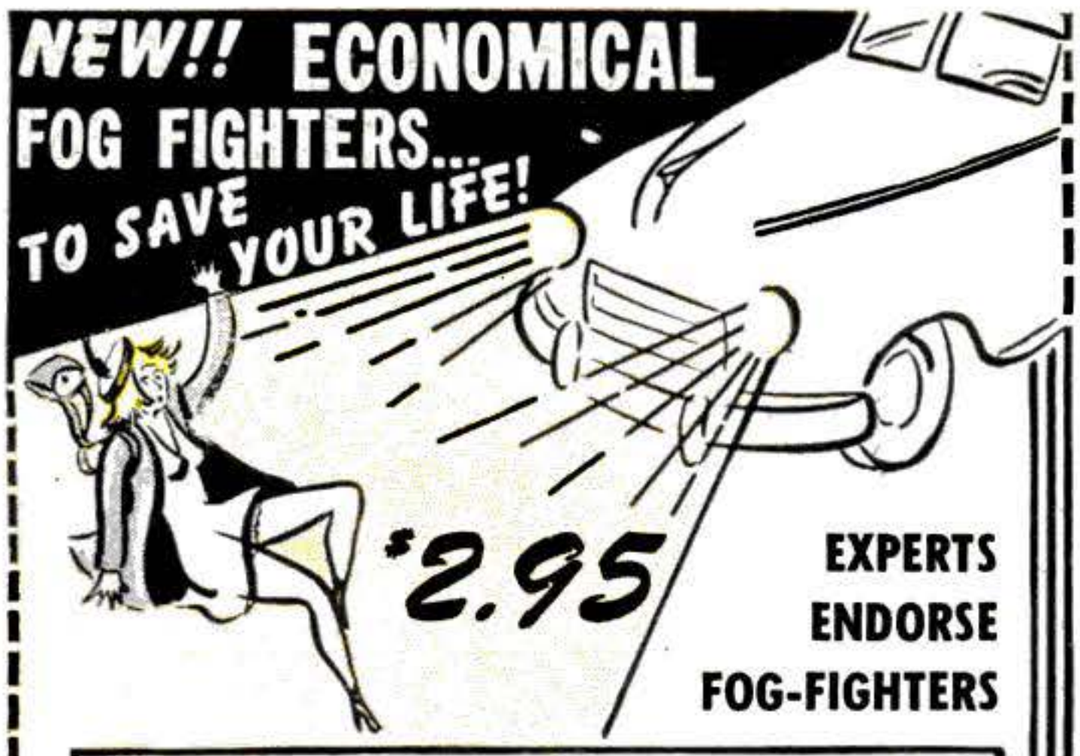

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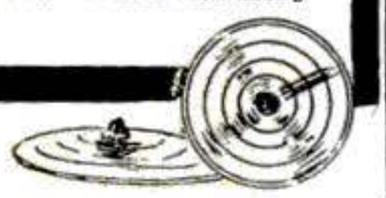

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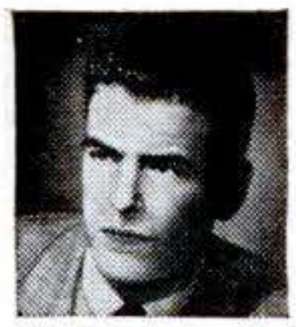

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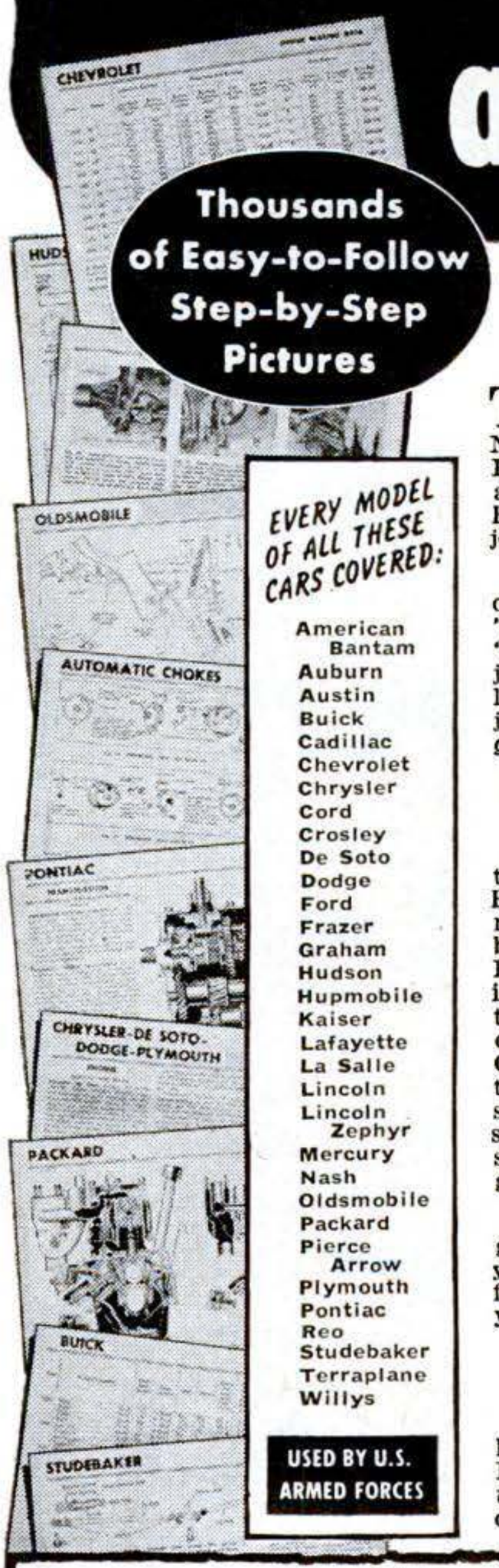

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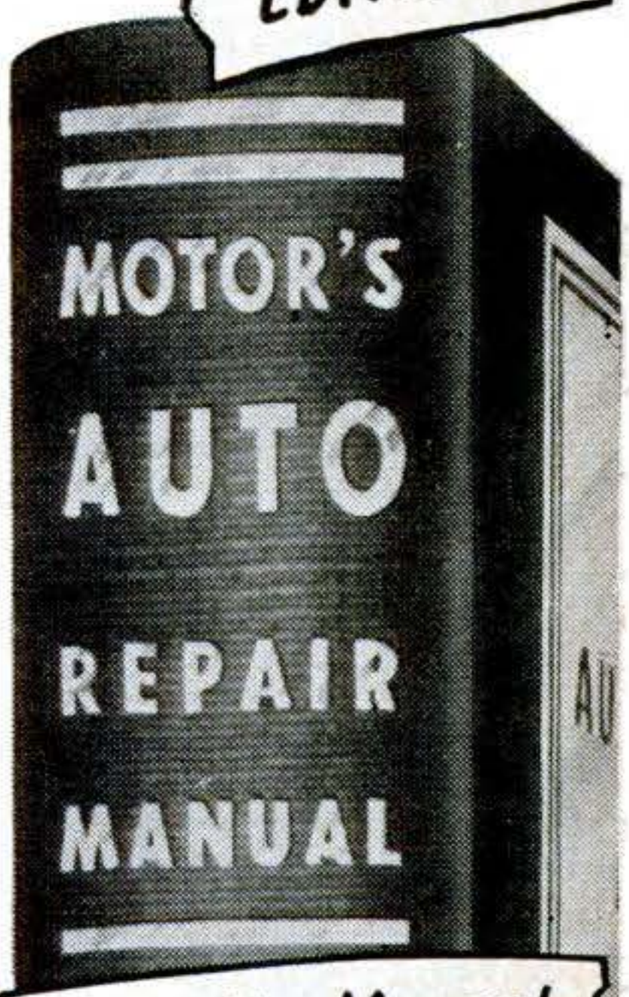

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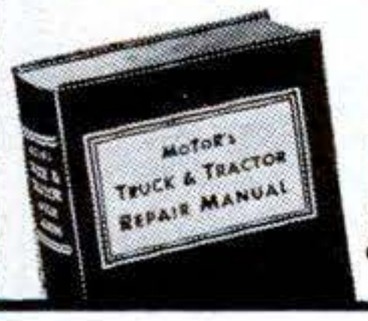

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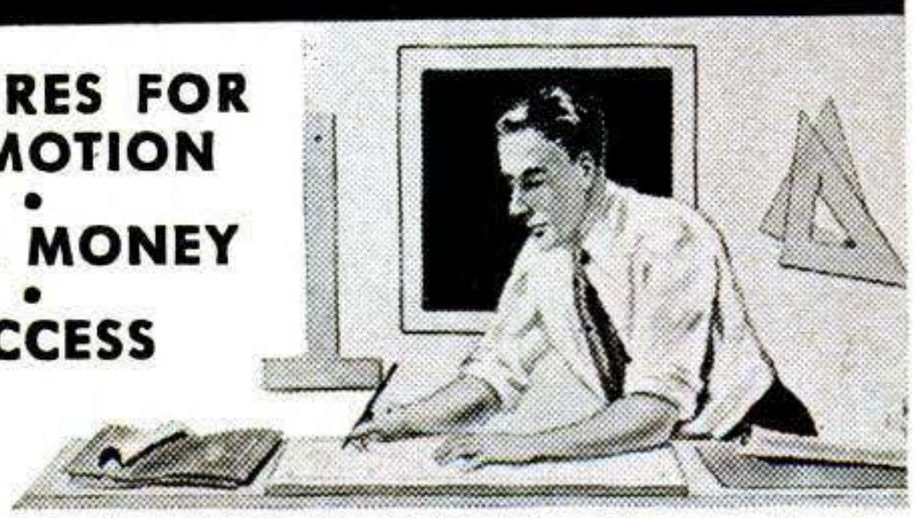

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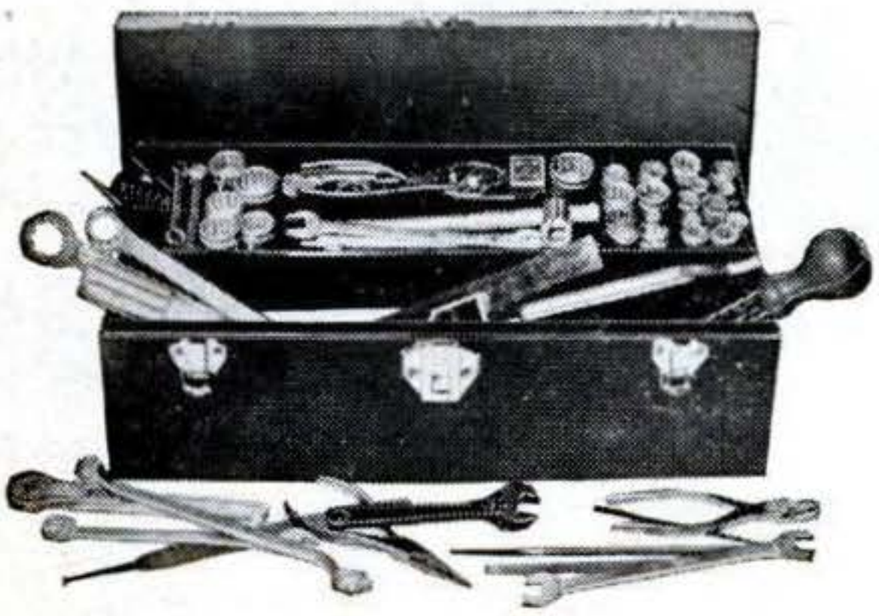

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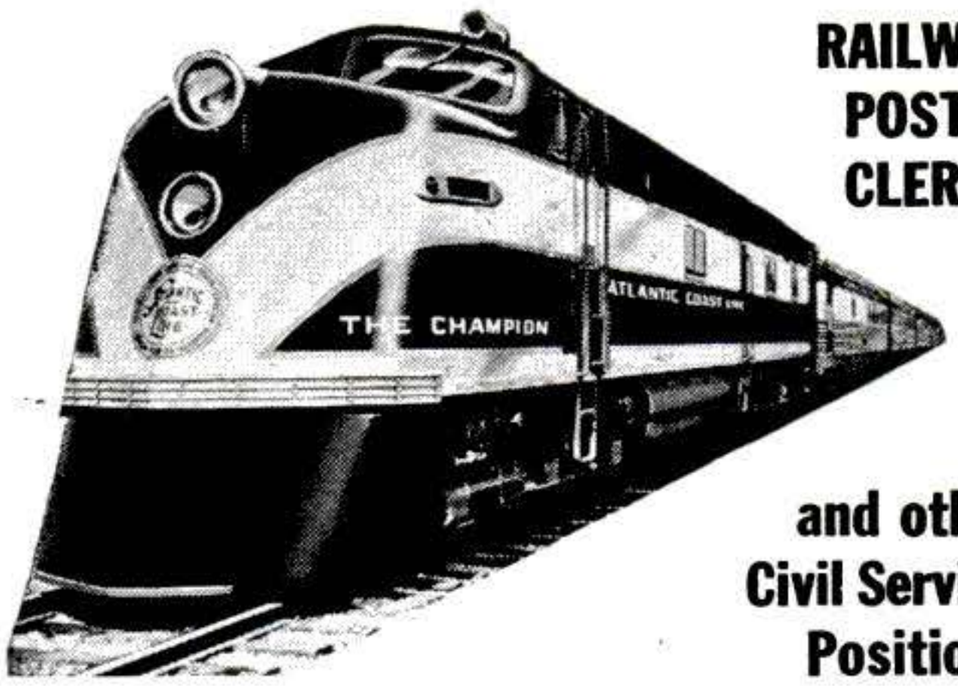

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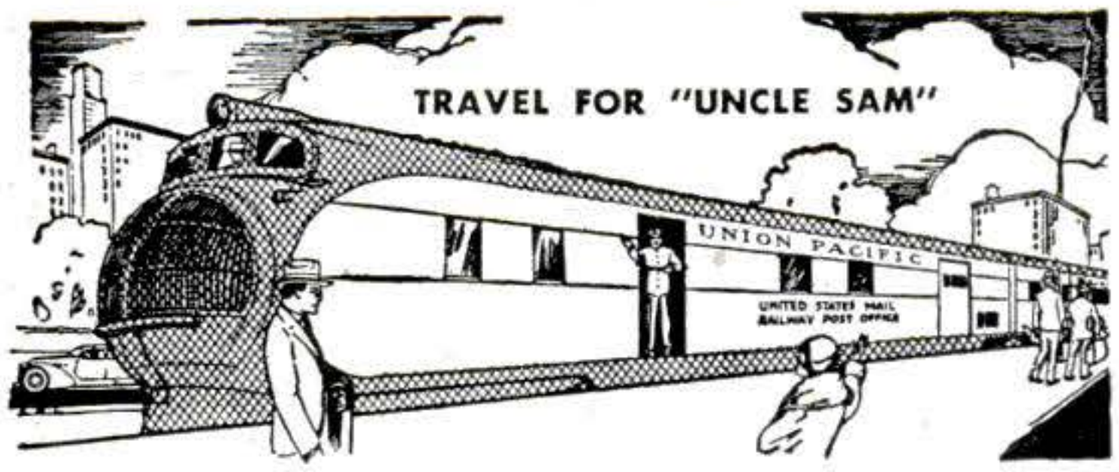

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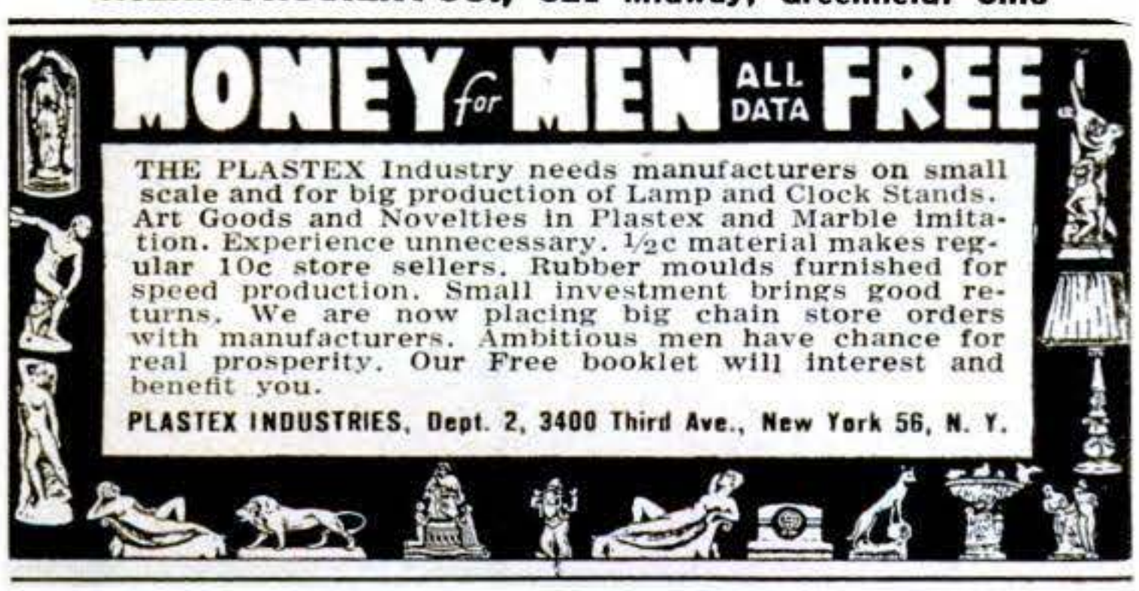

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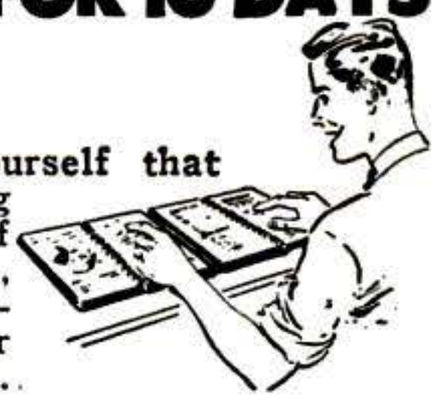

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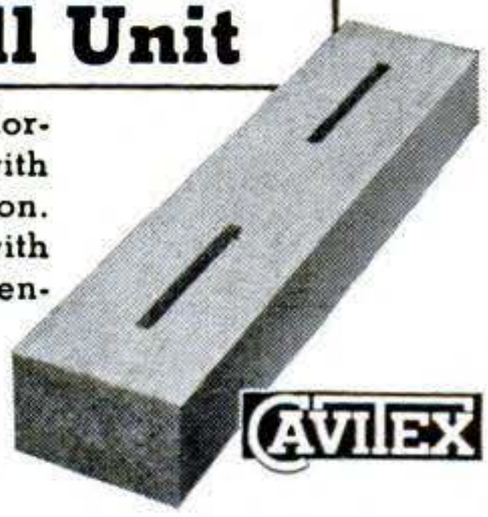

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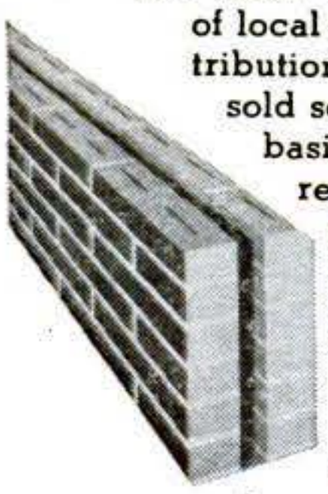

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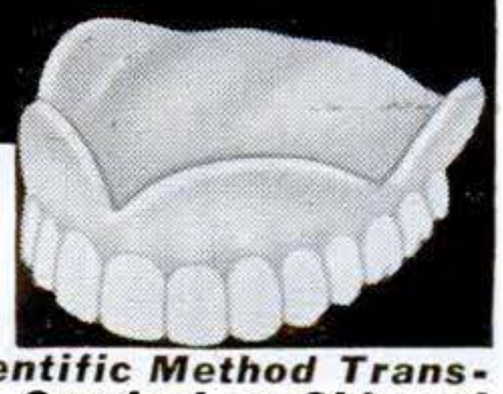

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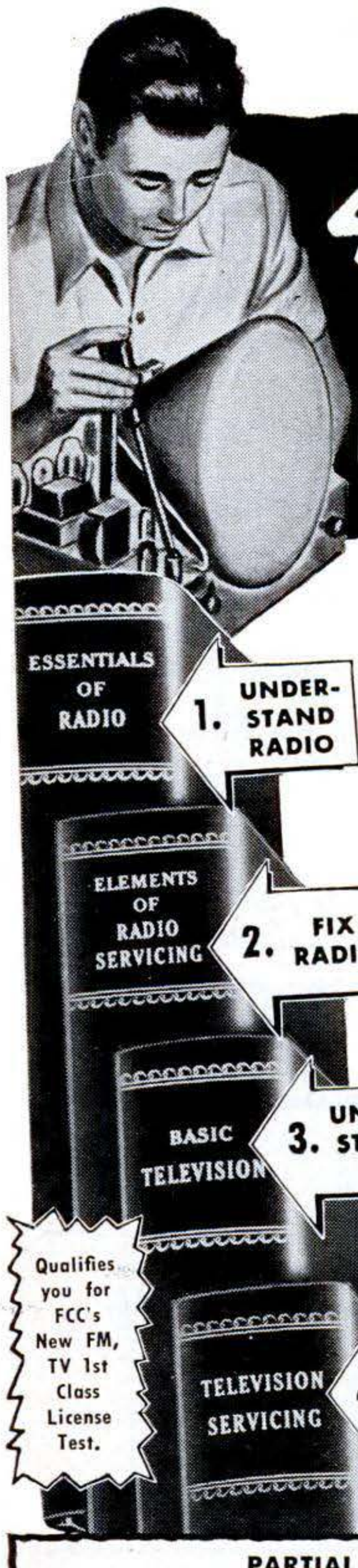

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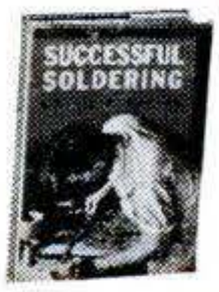

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650x15	4.34	650x20	7.84	750x20 (8)	8.54	1000x20	14.14
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650x15	5.68	700x15 (6)	6.98	32x6 (8)	10.48	1000x20	16.48
700x15	5.88	760x15	6.28	32x6 (10)	12.48	1100x20	17.58
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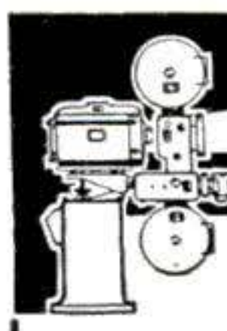

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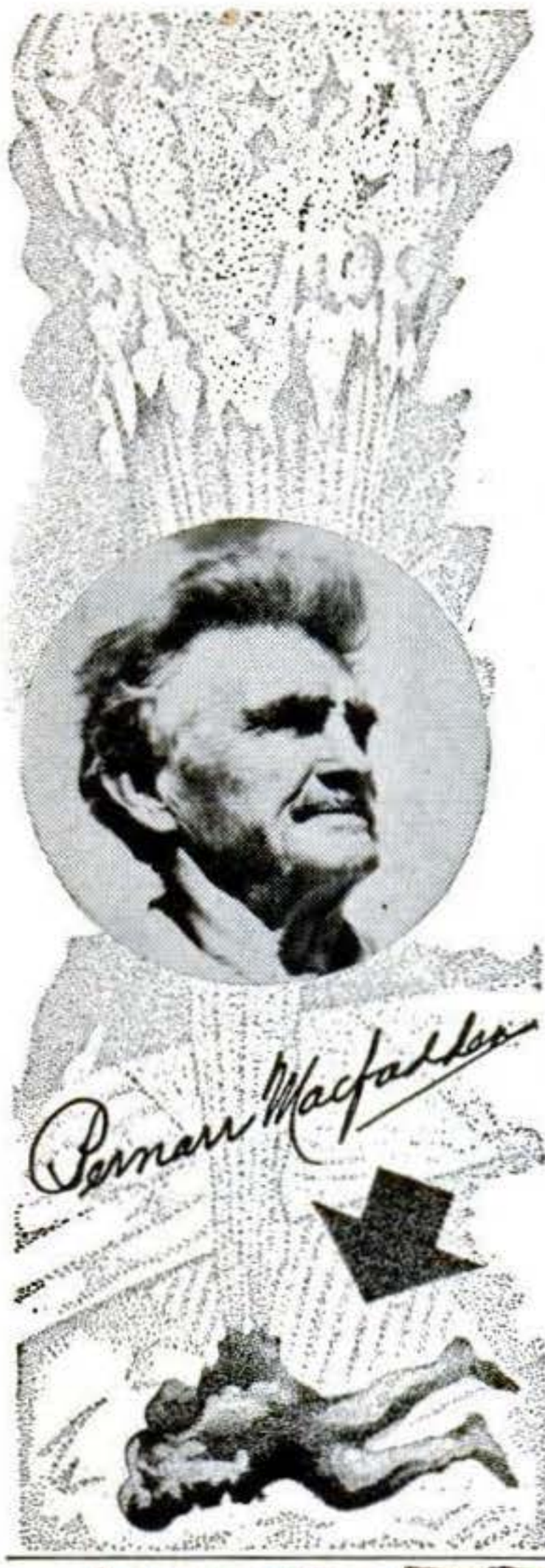

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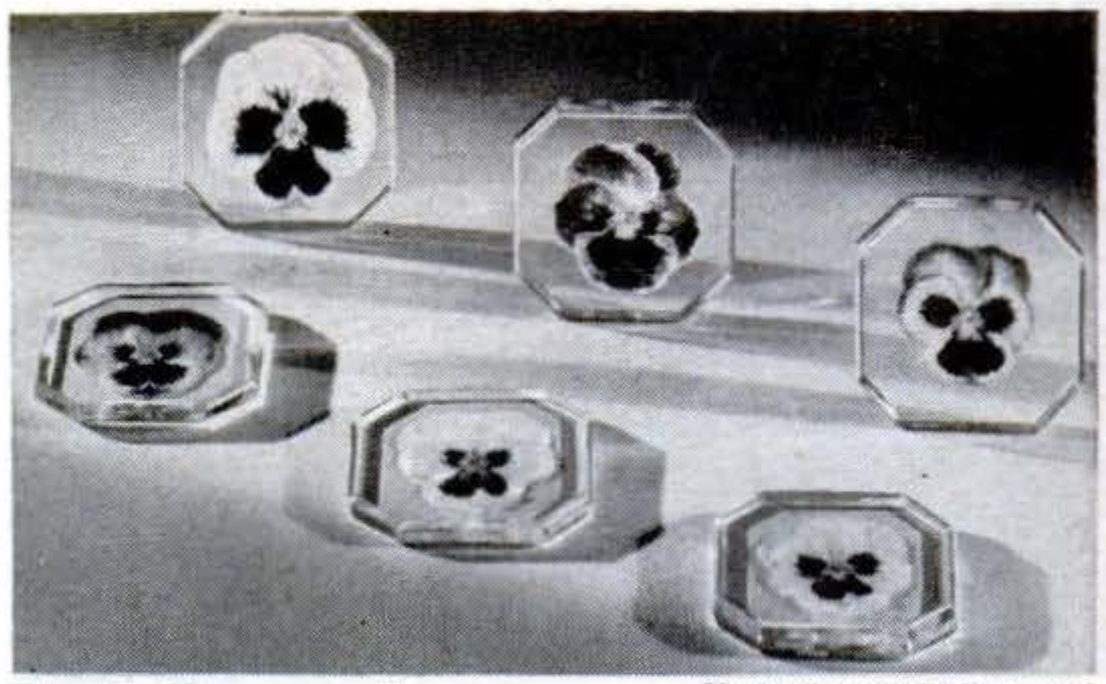

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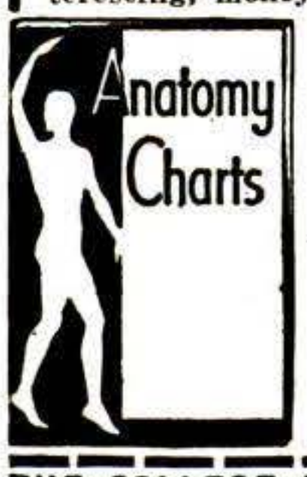

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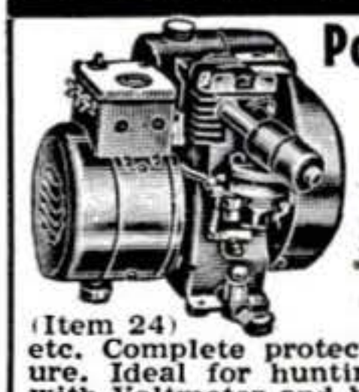

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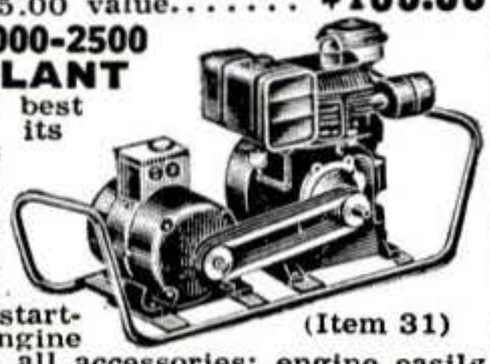

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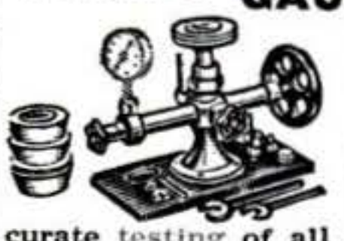

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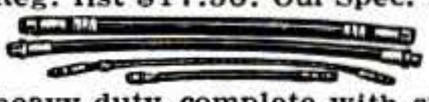

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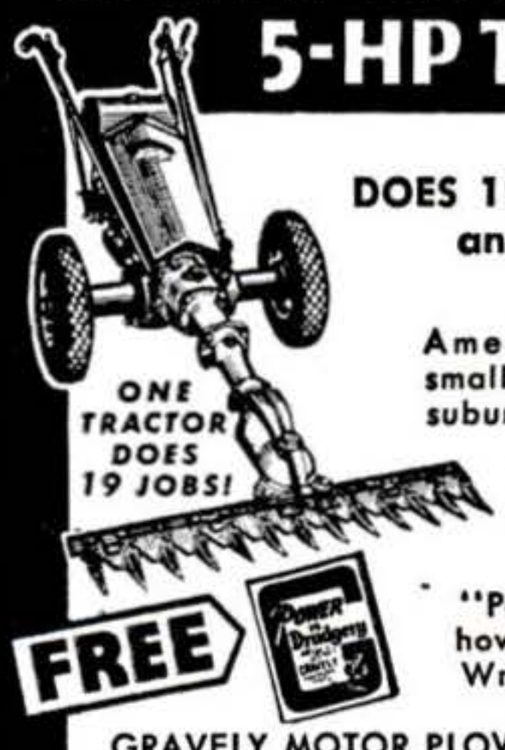

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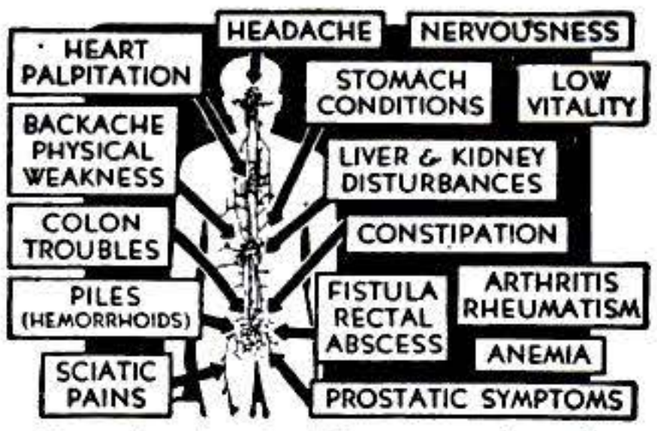

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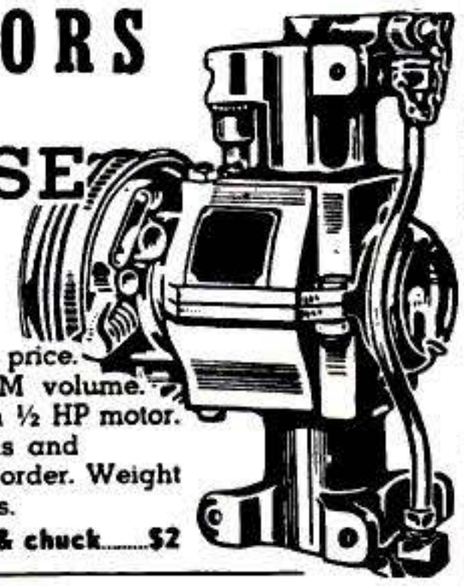

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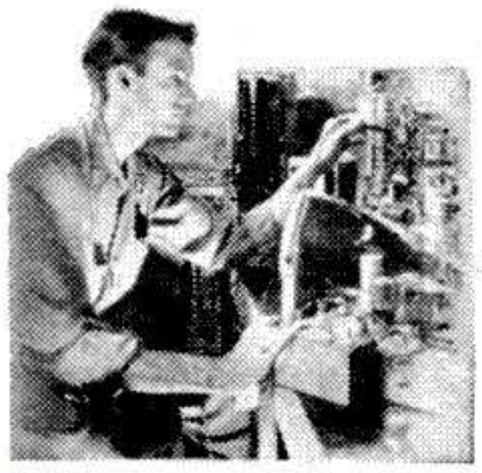

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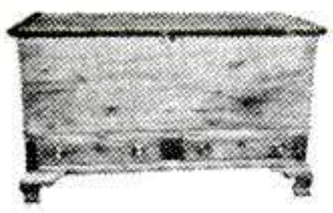

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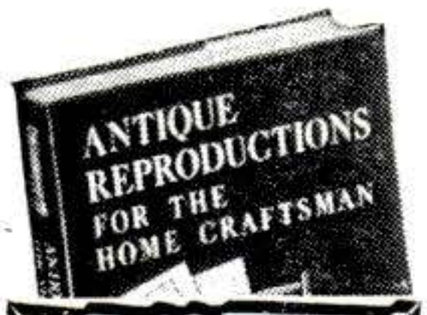

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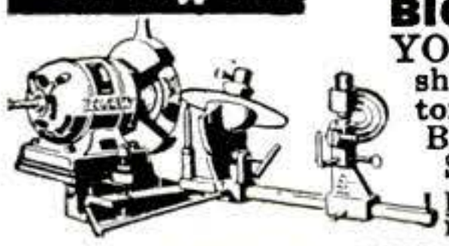

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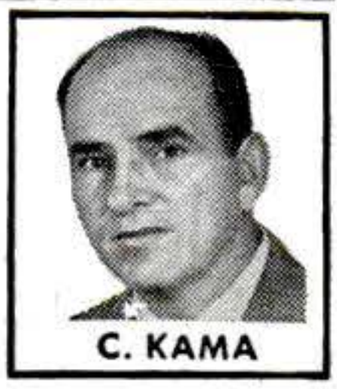

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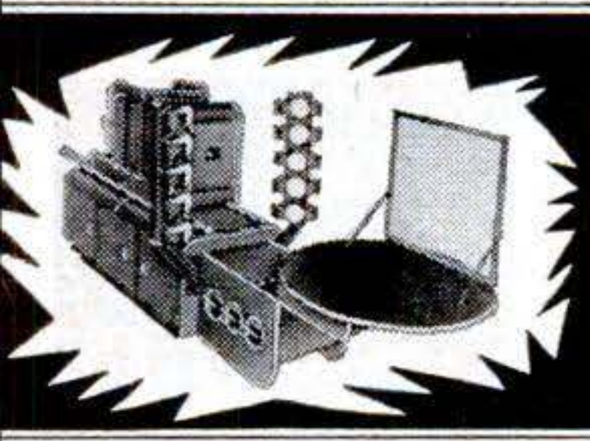

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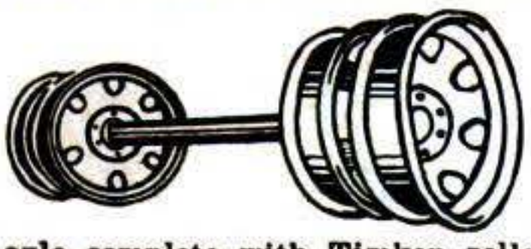

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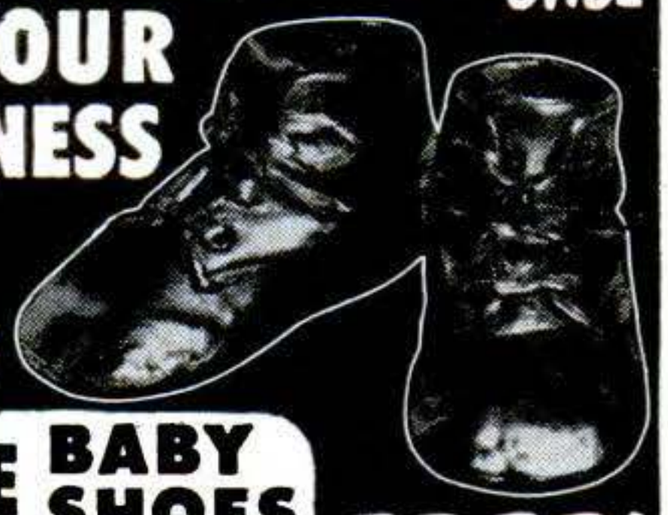

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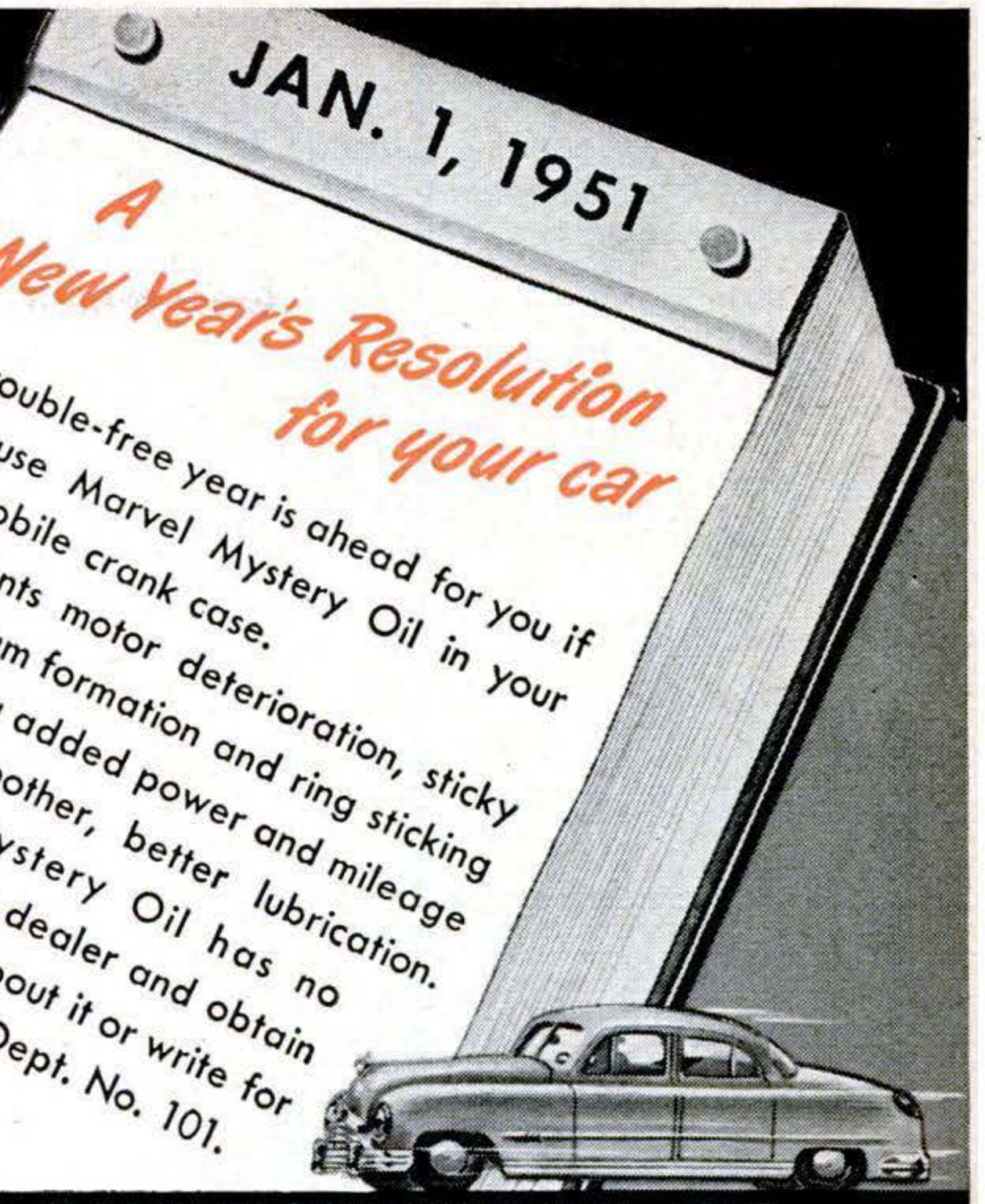

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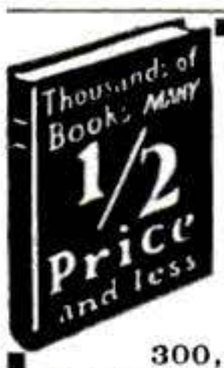

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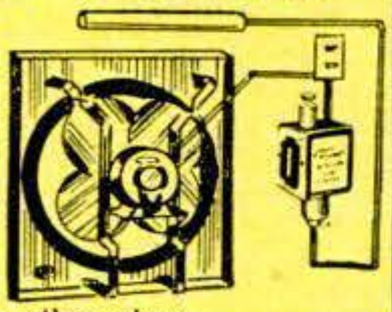

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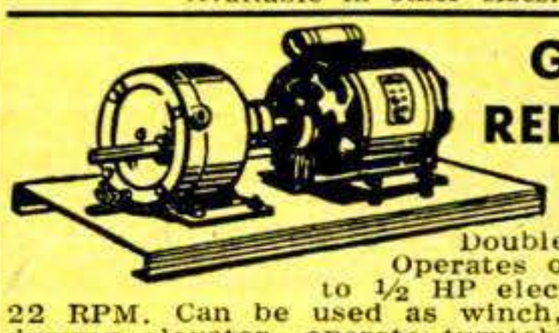

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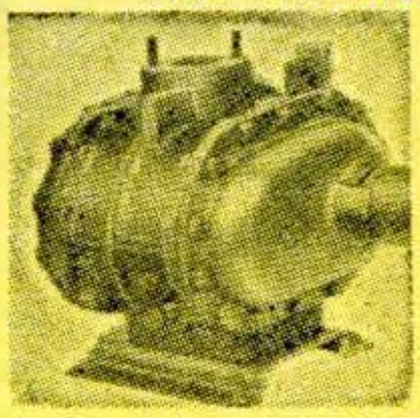

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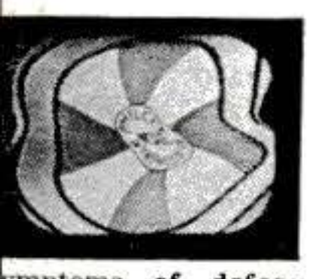

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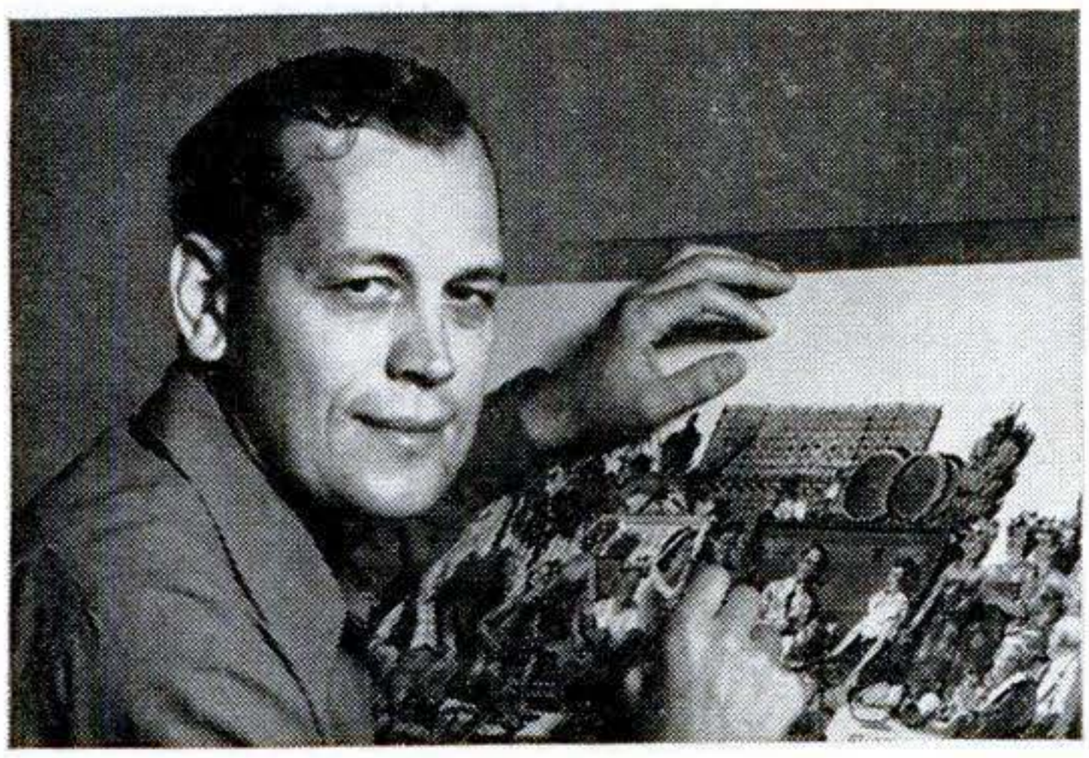

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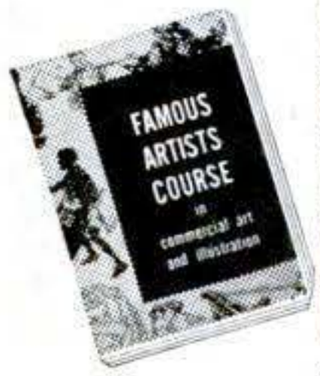

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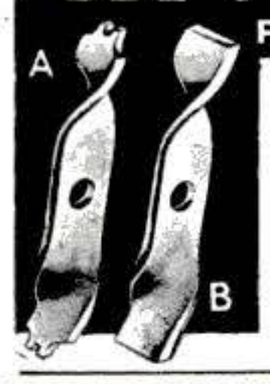

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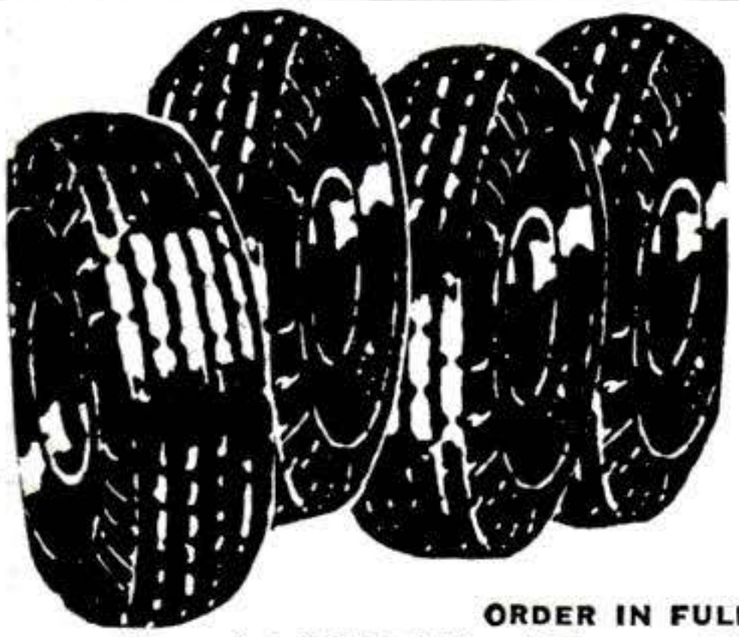

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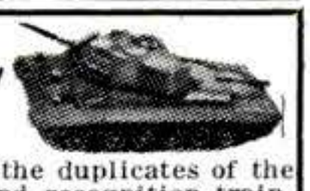

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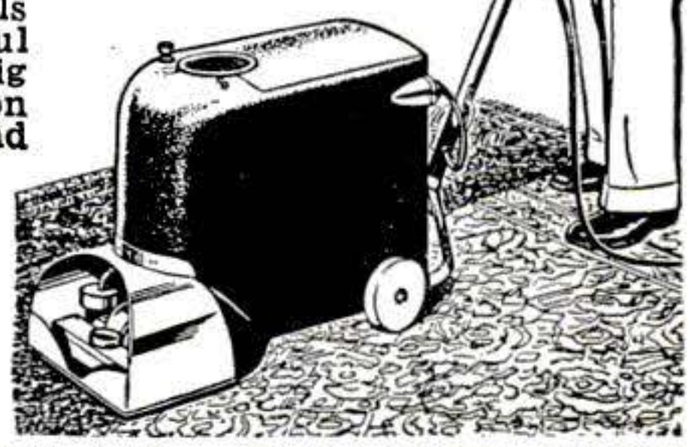

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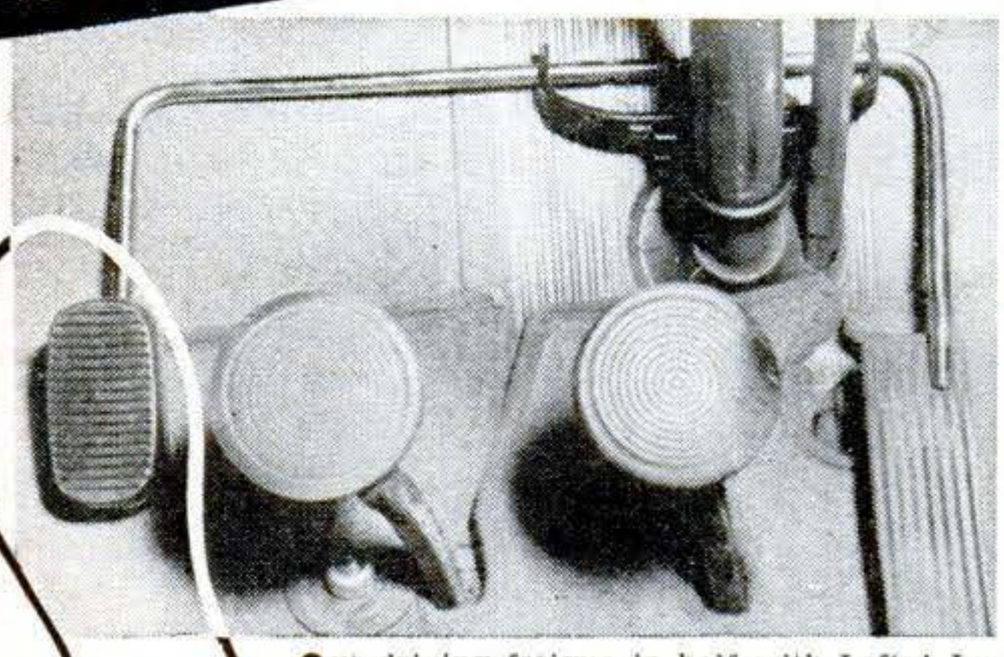

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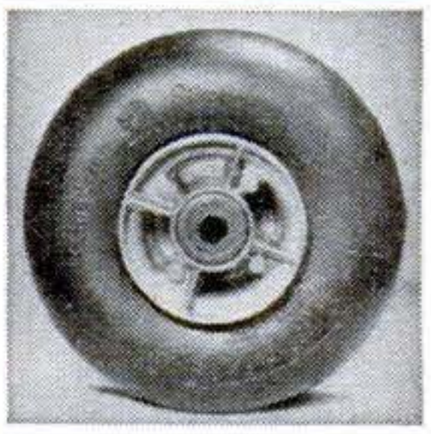

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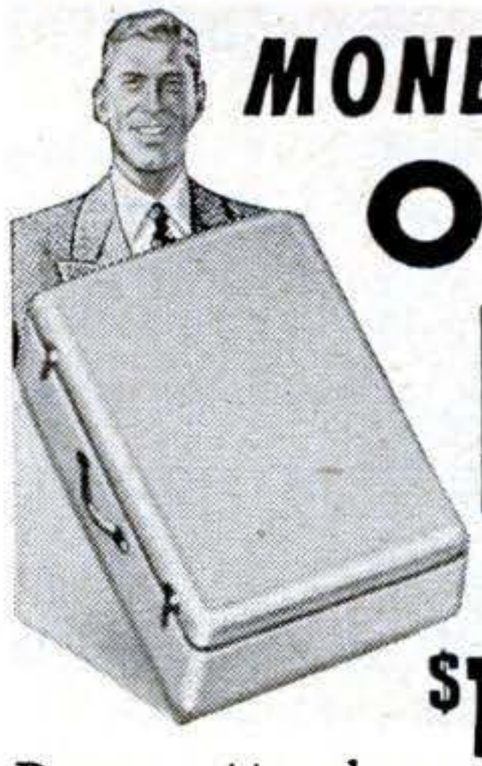

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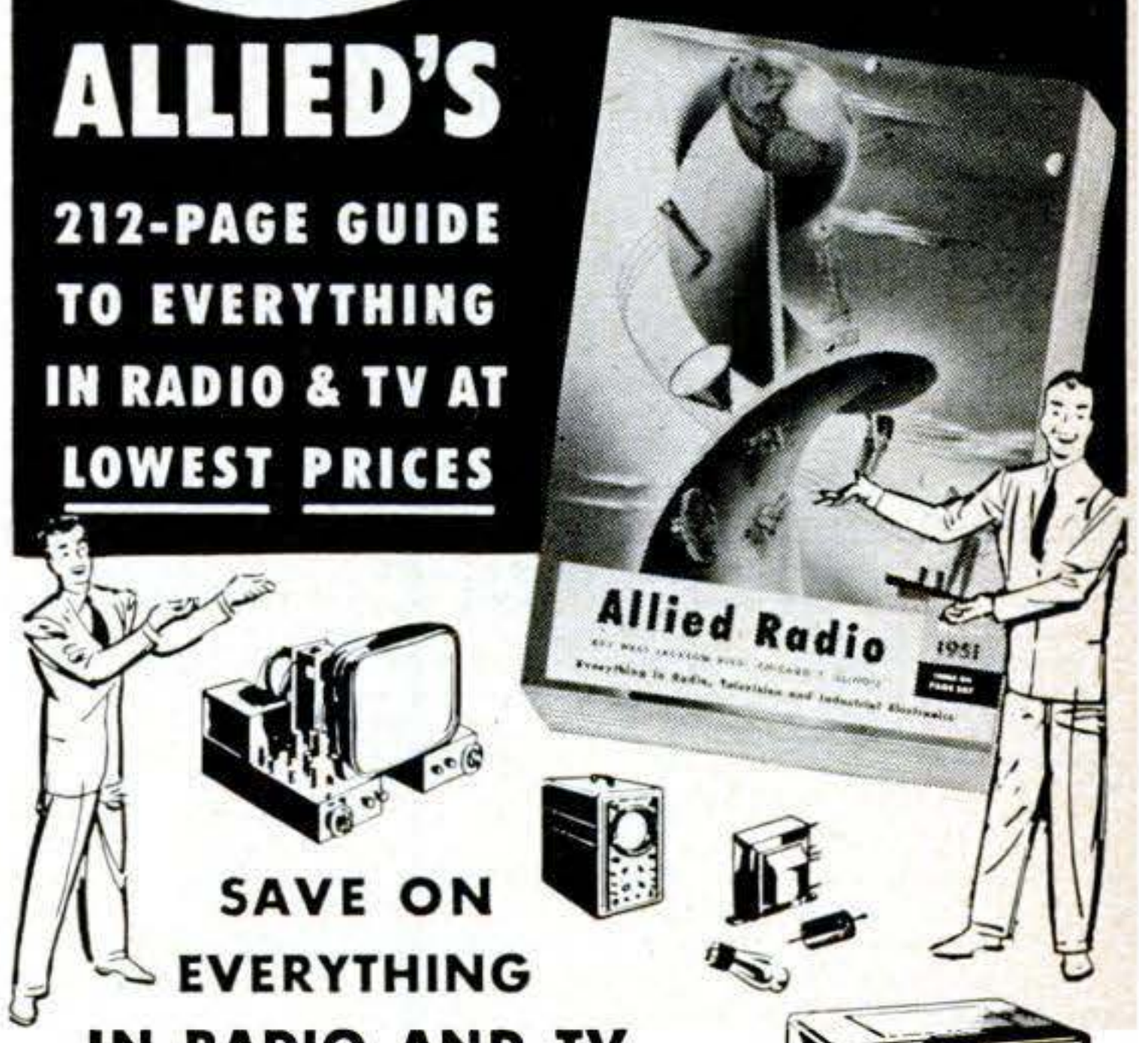

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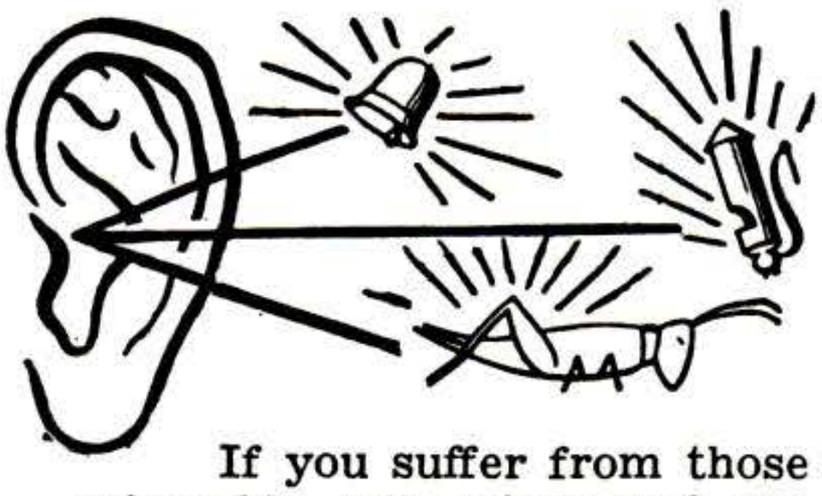

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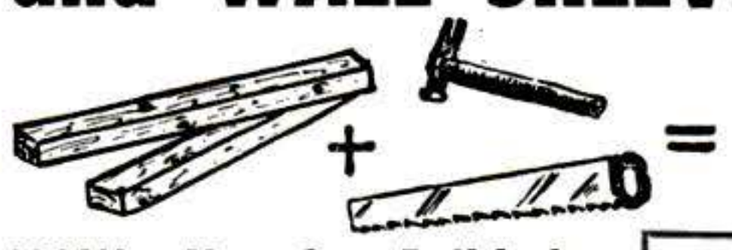

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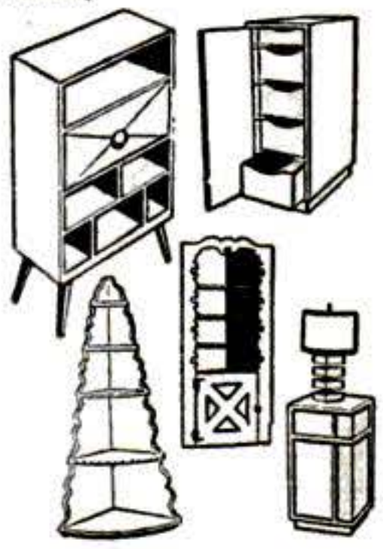

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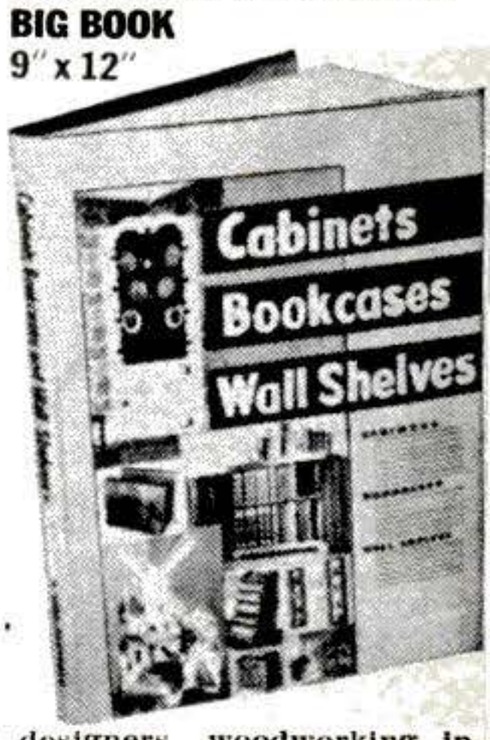

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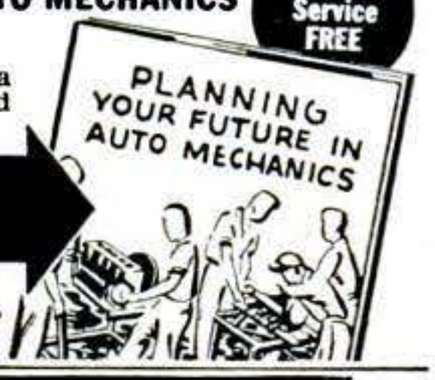

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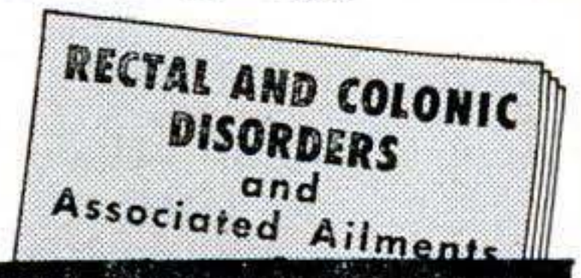

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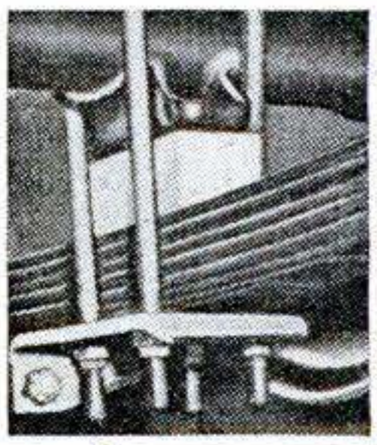

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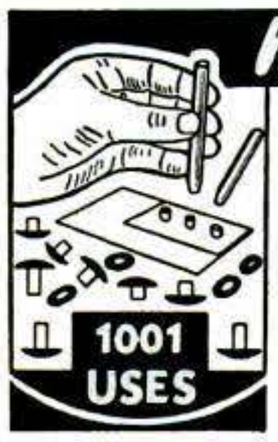

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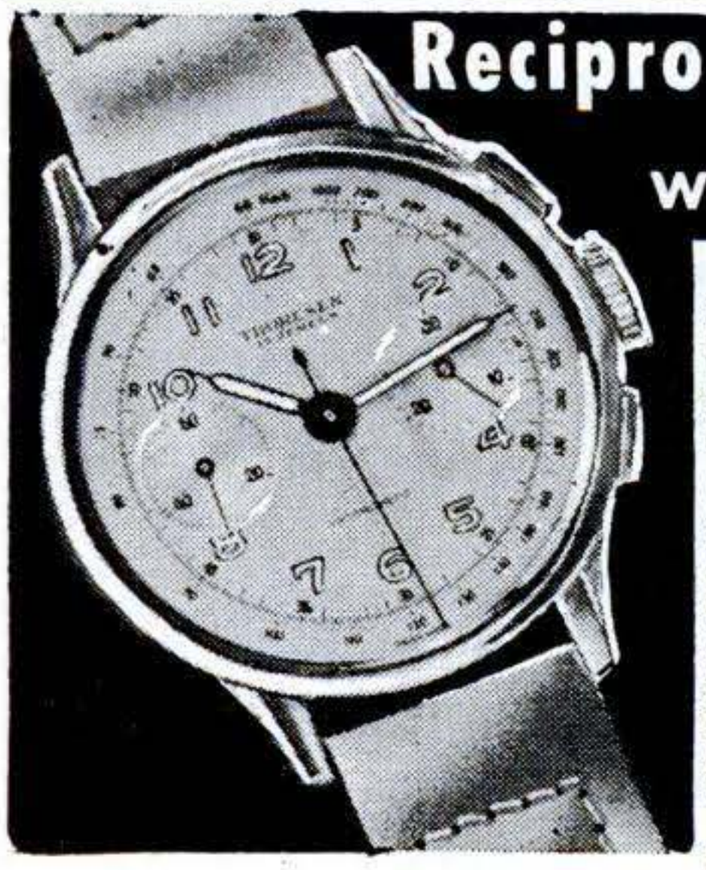

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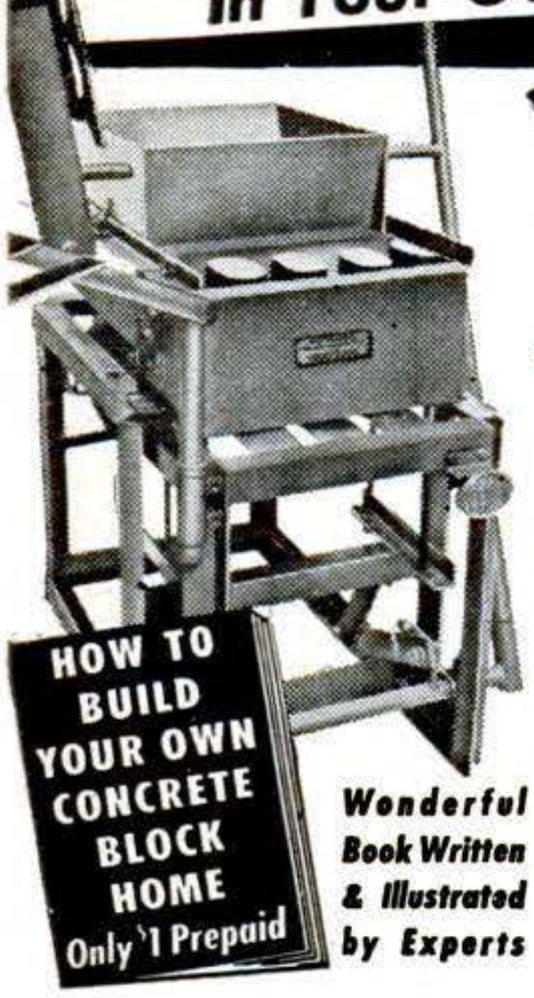

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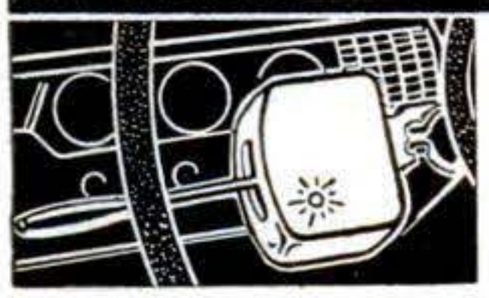

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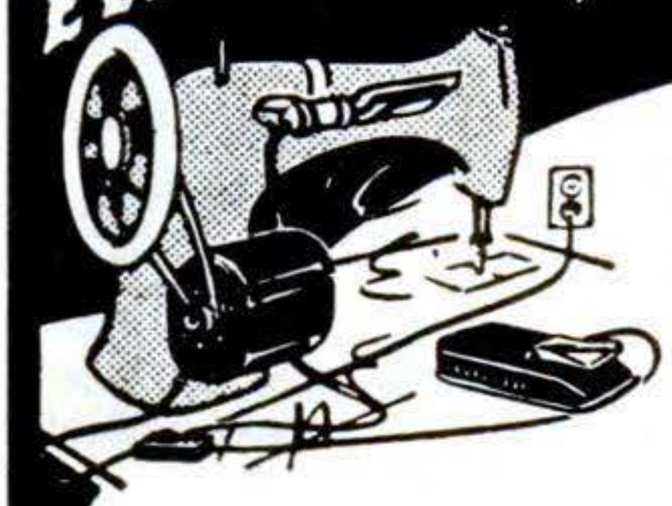

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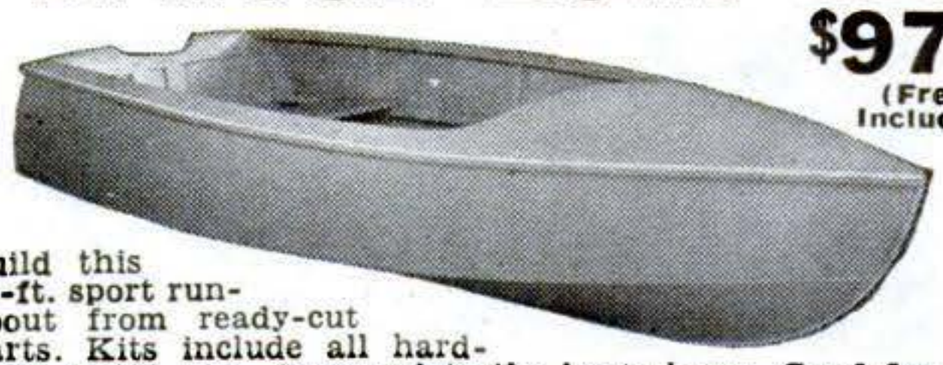

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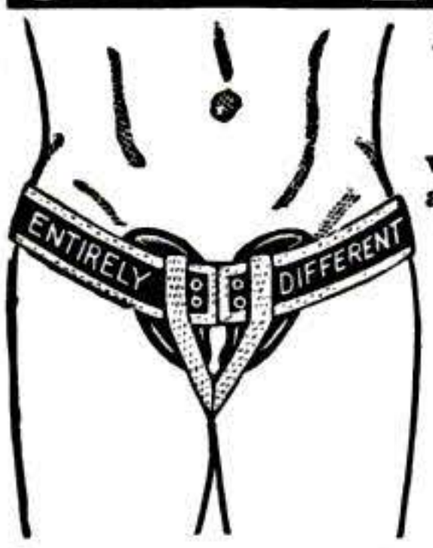

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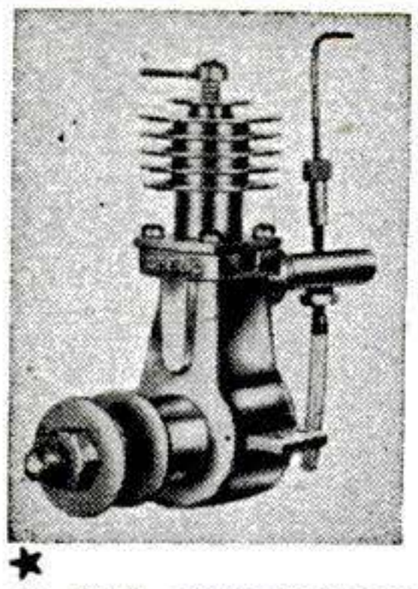

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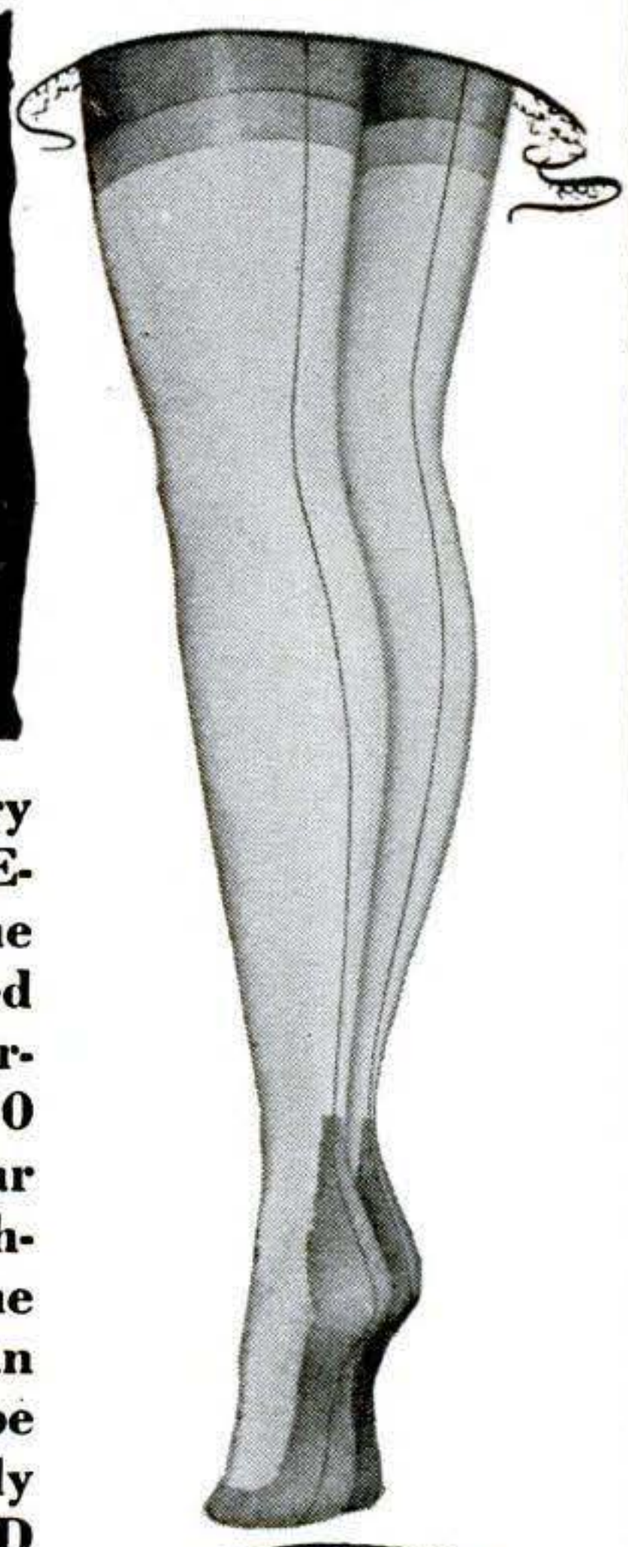

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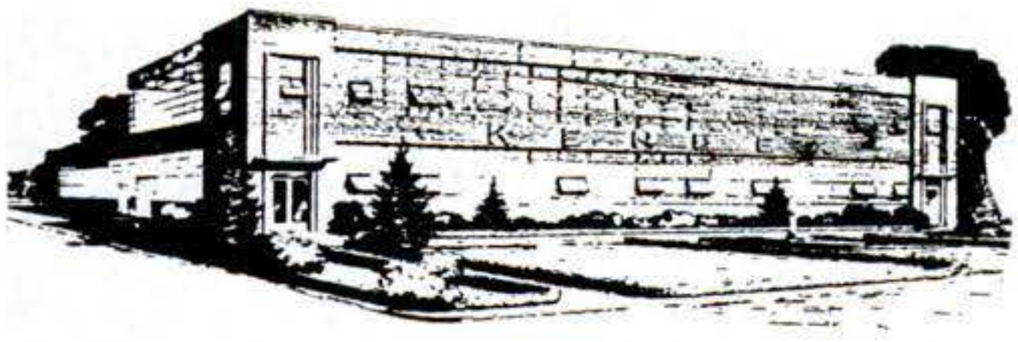

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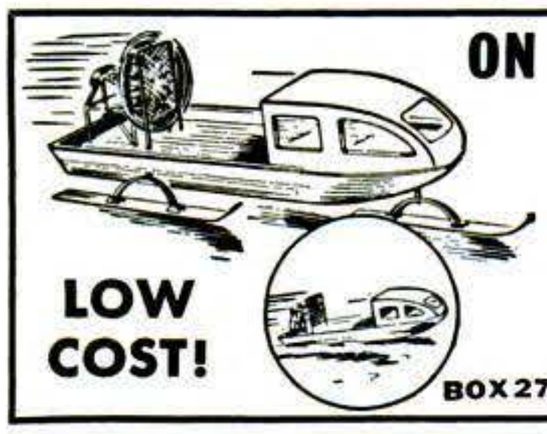

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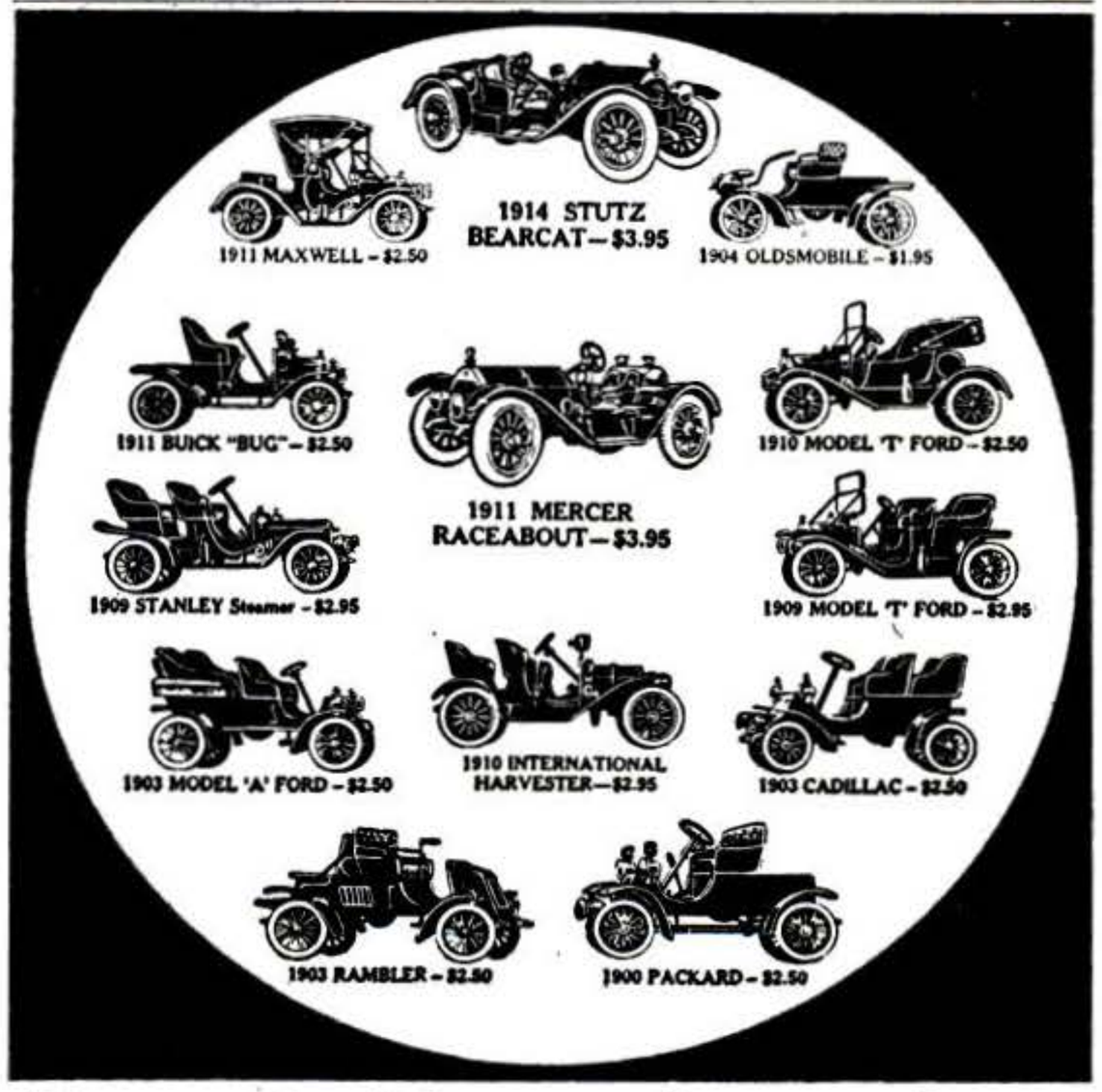

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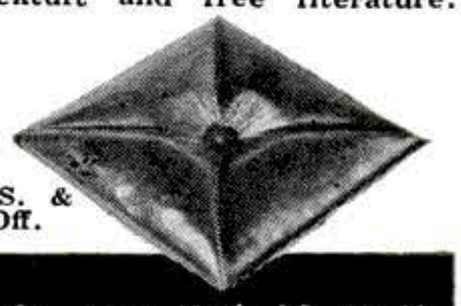

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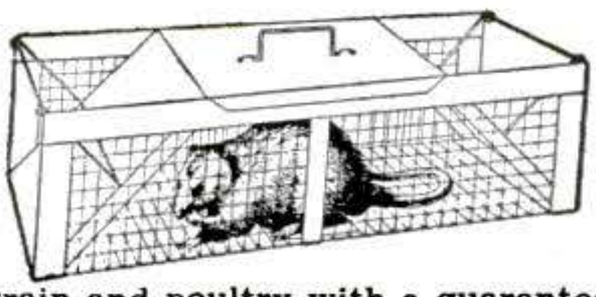

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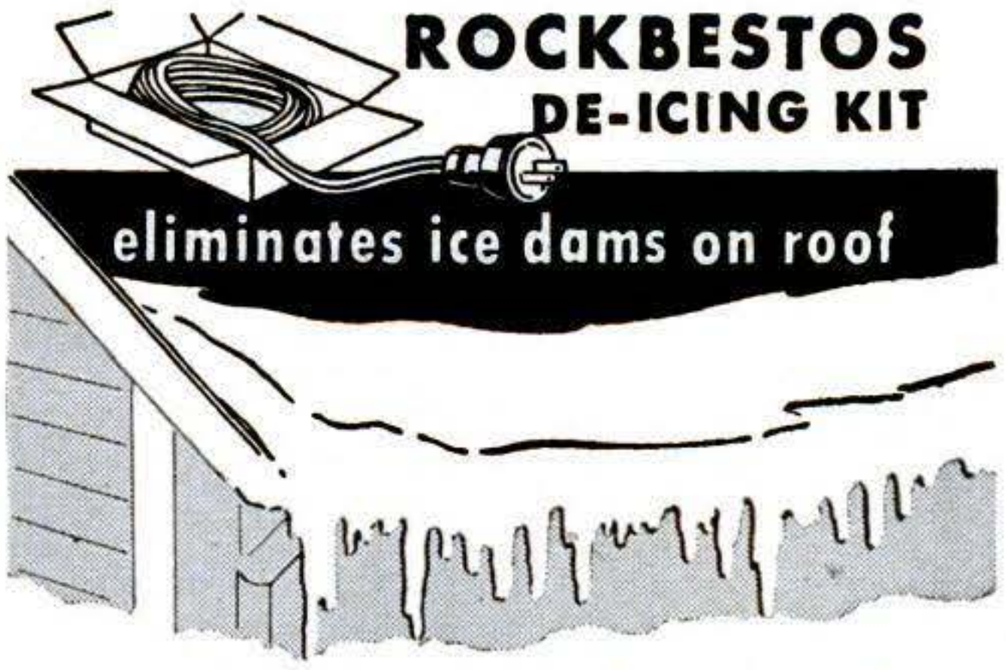

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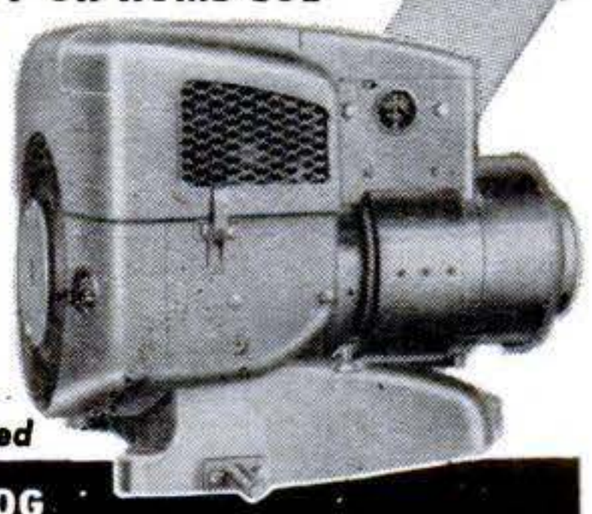

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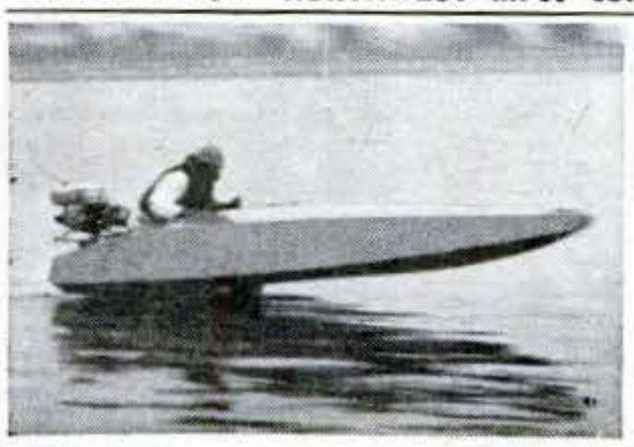

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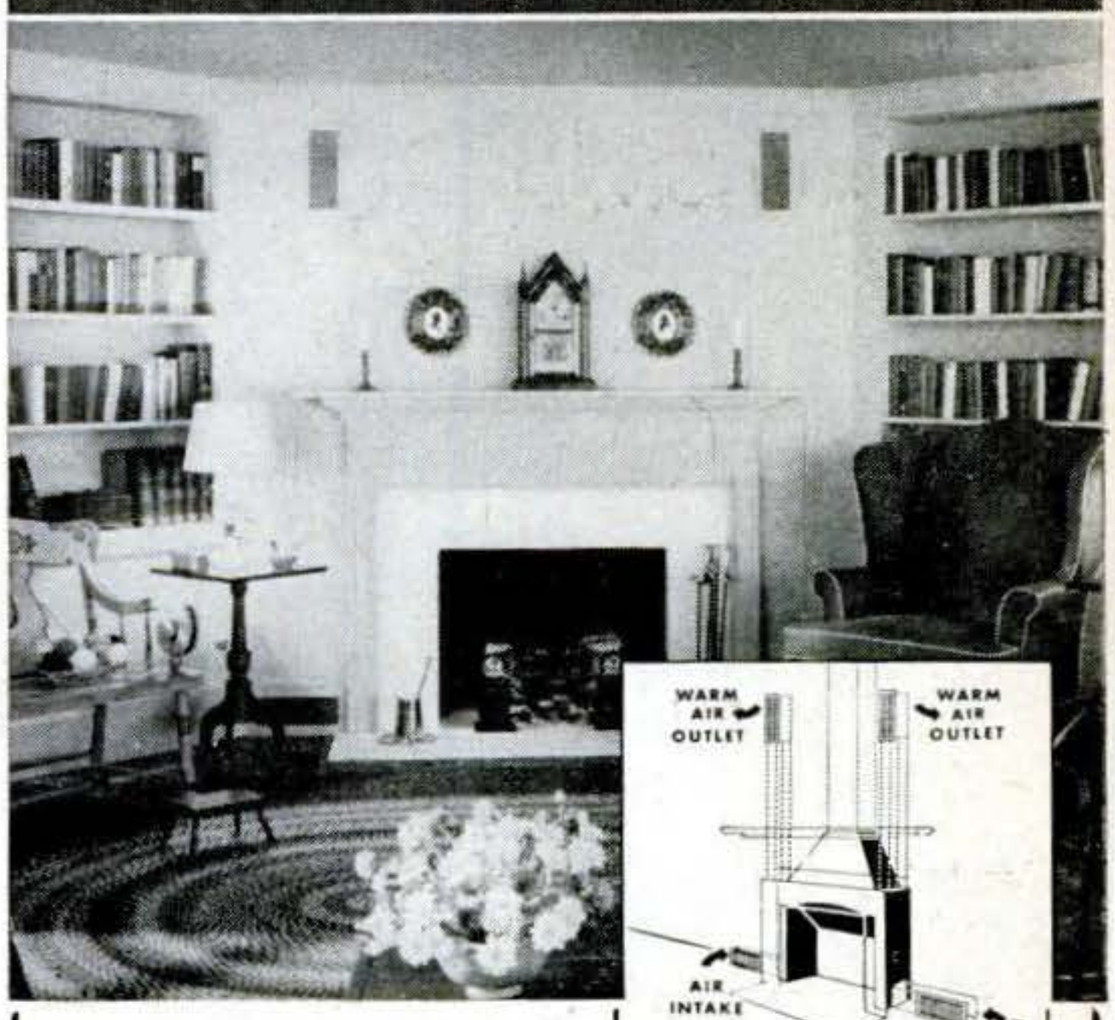

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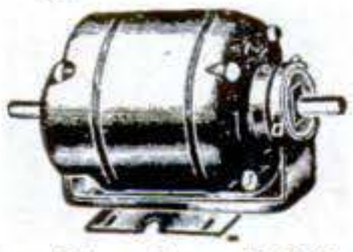

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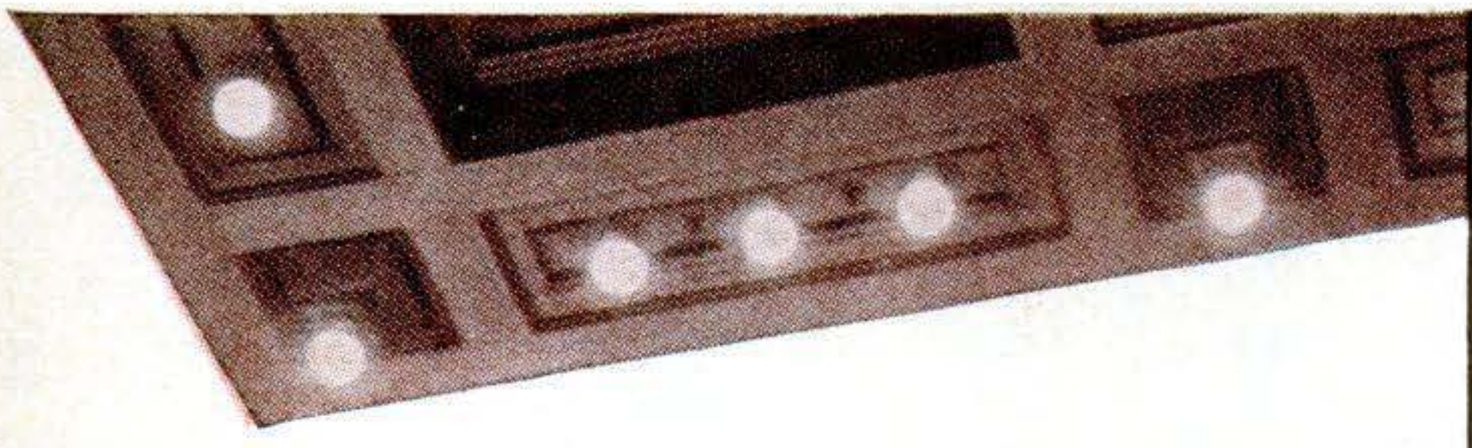

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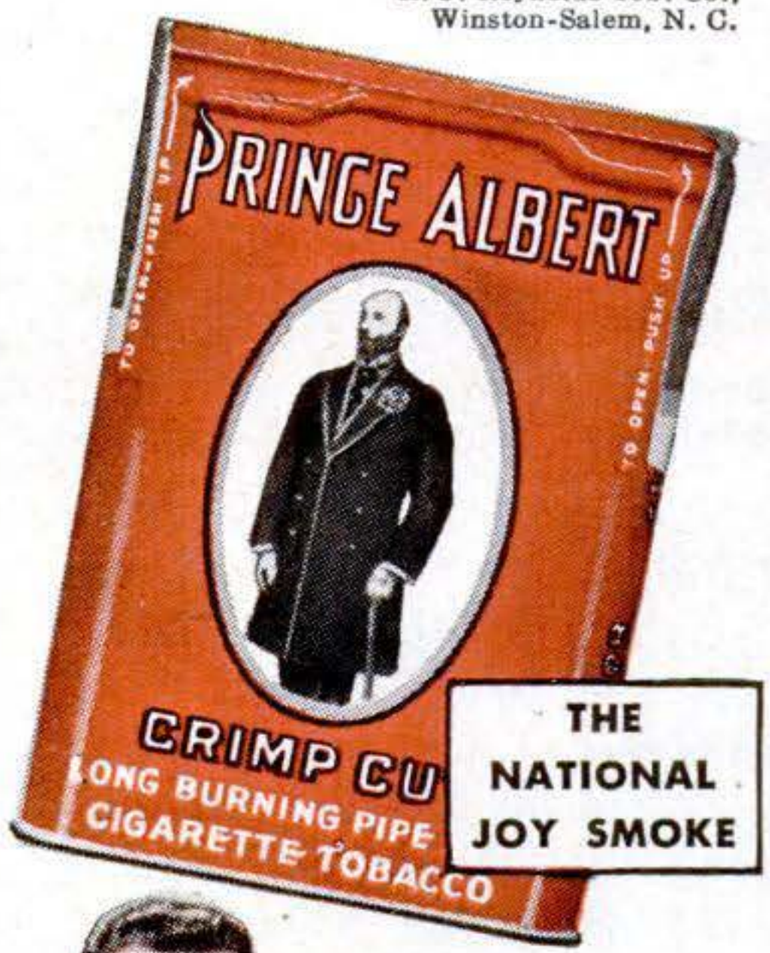

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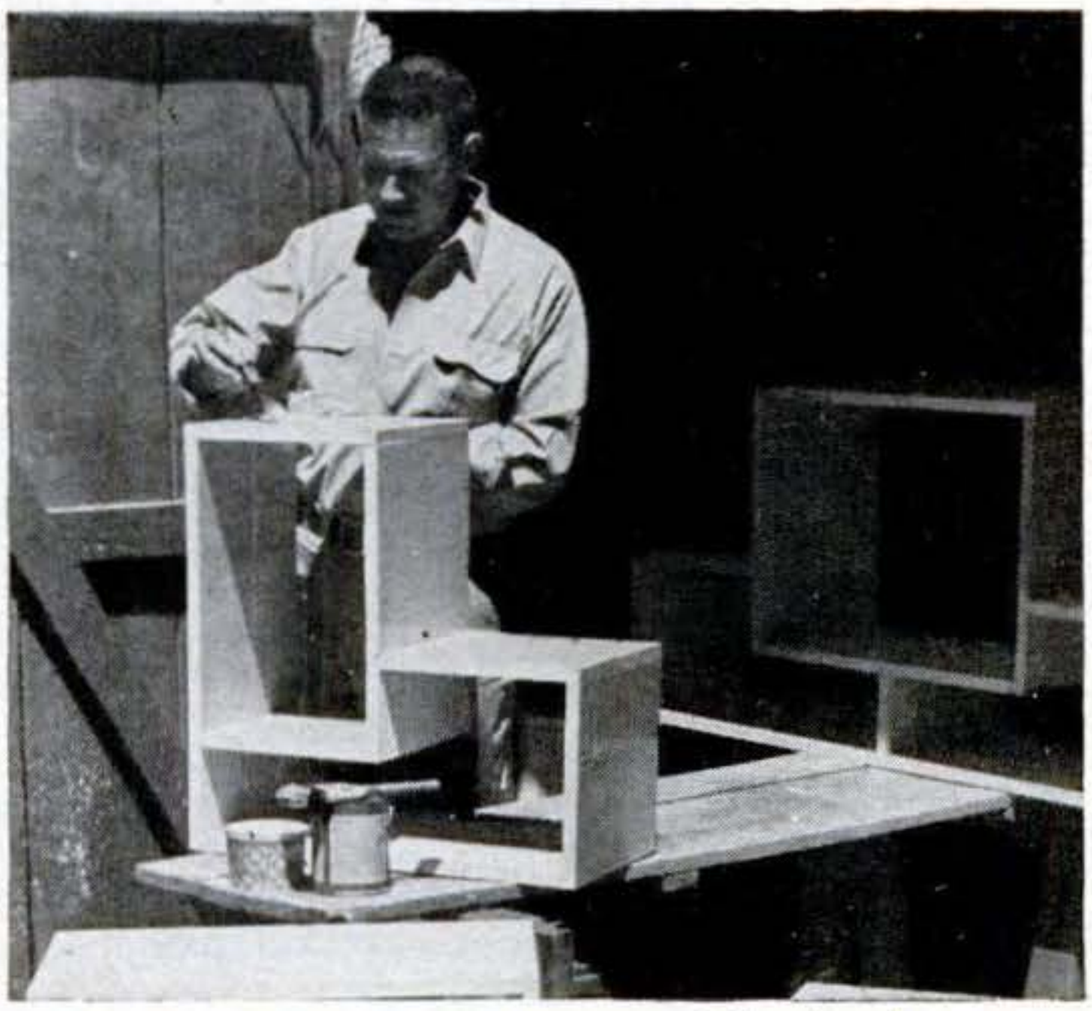

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How Deadly Are the Russian Jets?

Plenty, according to this intelligence estimate. They're soundly built, very fast. Some may be better than our own.

By William S. Friedman

DRAWINGS BY JO KOTULA

IT IS no secret that the Russians have a jet air force in the making. The question is, how good is it?

The USSR has only hinted at what it's doing. Ever since World War II Red jets have been flaunted before foreign diplomats in the great Moscow military demonstrations on May Day. Red Star fighters without propellers have ripped over Berlin now and then. They have been seen off Bering Strait, where the farthest finger of Alaska almost touches Asia. The occasional encounters between U. S. planes and Russian-designed jets over Korea so far have disclosed few significant details.

But it is possible, using the techniques of military intelligence, to put together bits and pieces into a fairly good picture of Russia's growing jet air force.

From pictures and descriptions in foreign journals—including some from behind the Iron Curtain—from private sources in England, France, Holland, Sweden, Hungary, Finland, and Roumania, much illuminating information can be put together.

Here's how these conclusions shape up:

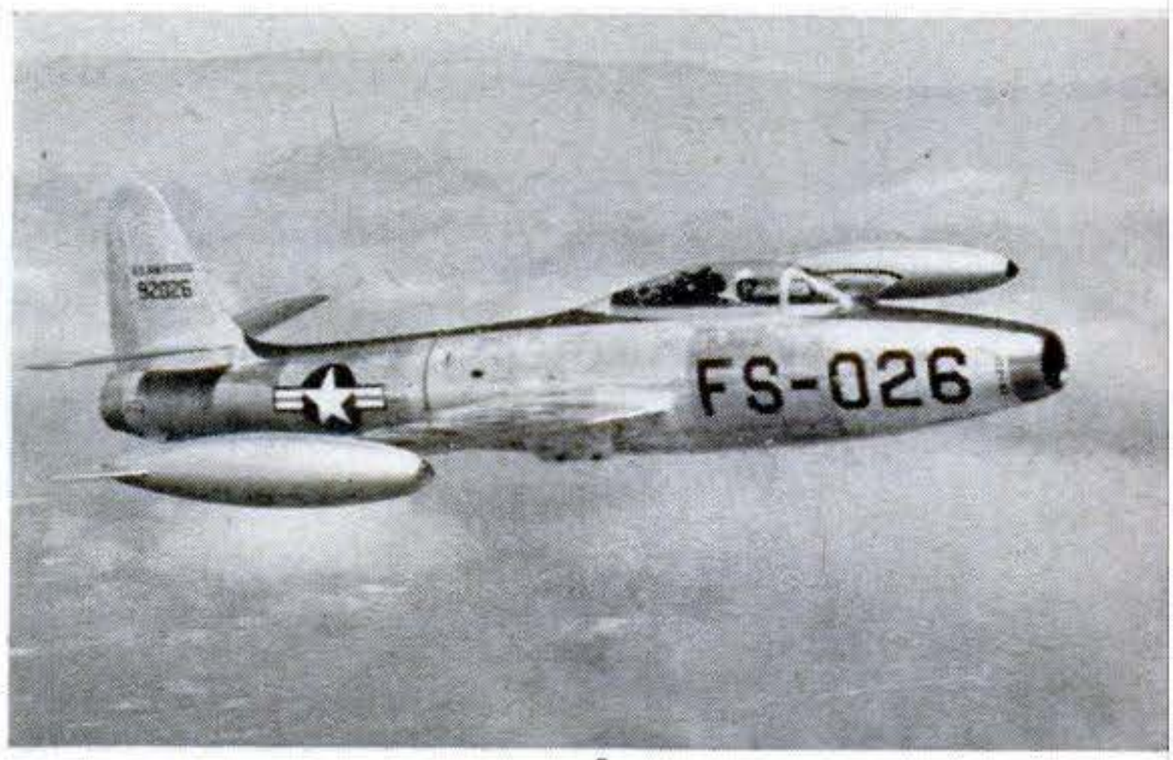
1. Russia is well abreast of the rest of the world in ultra-fast military aircraft.

2. In at least one type of plane the Russians are ahead of the United States.

3. The USSR jet air force is big, far bigger than ours.

4. Red fighter strength is invested main-

The most advanced design in operational Russian fighter planes probably is Yak-25, which may be compared with our Republic F-84F jet, formerly called F-96 (inset). Each can do over 650 m.p.h. Thrust is practically identical—5,300 lb. for the U. S. fighter; 5,200 for the Yak. F-84F weighs 12½ tons. Yak weight is unre-



Yak-19 jet fighter (right) stacks up against U. S. Republic F-84E. Each does over 625 m.p.h., and weighs around 10 tons. F-84 (above) is powered by Allison J-35 turbojet rated at 5,000-lb. thrust; Yak, by Chelomey engine of similar thrust, adapted from British Rolls-Royce Nene. Armament of Russian plane is two 32-mm. cannon, two 12.7-mm. machine guns, plus rockets or bombs, compared with six .50-cal. machine guns plus 4,000 lb. of rockets and bombs for U. S. fighter. This Yak bears tes-

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ported. Yak carries two 32-mm. rapid-fire cannon. F-84F's armament is confidential. Yak is being delivered in strength to USSR first-line guard squadrons.

timony to fact that Russian designs at least keep pace with developments in other countries, and here and there take the lead. Yak-19 is reported in major production. For two years fighter squadrons have received them in quantity.

Designer of Yak series is Alexandre Yakovlev, most prolific producer among Reds' aircraft engineers.

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ly in jet planes, not in piston-engined ones.

5. One night fighter has the sharp sweepback wing characteristic of planes capable of penetrating the speed of sound.

6. A rocket fighter, for the local defense of important areas, is reported to have a top speed in excess of that of sound.

7. A 40-ton ground-support and medium-range bomber, powered by four turbojets, is reported operational in squadron strength.

8. The Russians are not known to have anything comparable to the U. S. B-47 six-engine superbomber in the jet classification.

Before going into the details it's pertinent to note than any resemblance between U. S. and Russian military aircraft may be purely coincidental. The comparisons in the pictures on these pages are not to show similarity but to point up contrasts.

Copycats All

If the Russians have copied American—and, more extensively, German—designs, they have done no more than we have done in borrowing freely from the British and the Germans. It was Britain, not the United States, that designed the first practical gas turbine engine for airplanes. It was Germany, not the United States, that produced the first rocket airplane.

The most important fact of the Reds' jet air force is the type of planning that has governed its growth. At the close of World War II Russia was behind the U. S. technically in the air. In the intervening five years Russia has expanded her air potential while, until recently, we contracted ours.

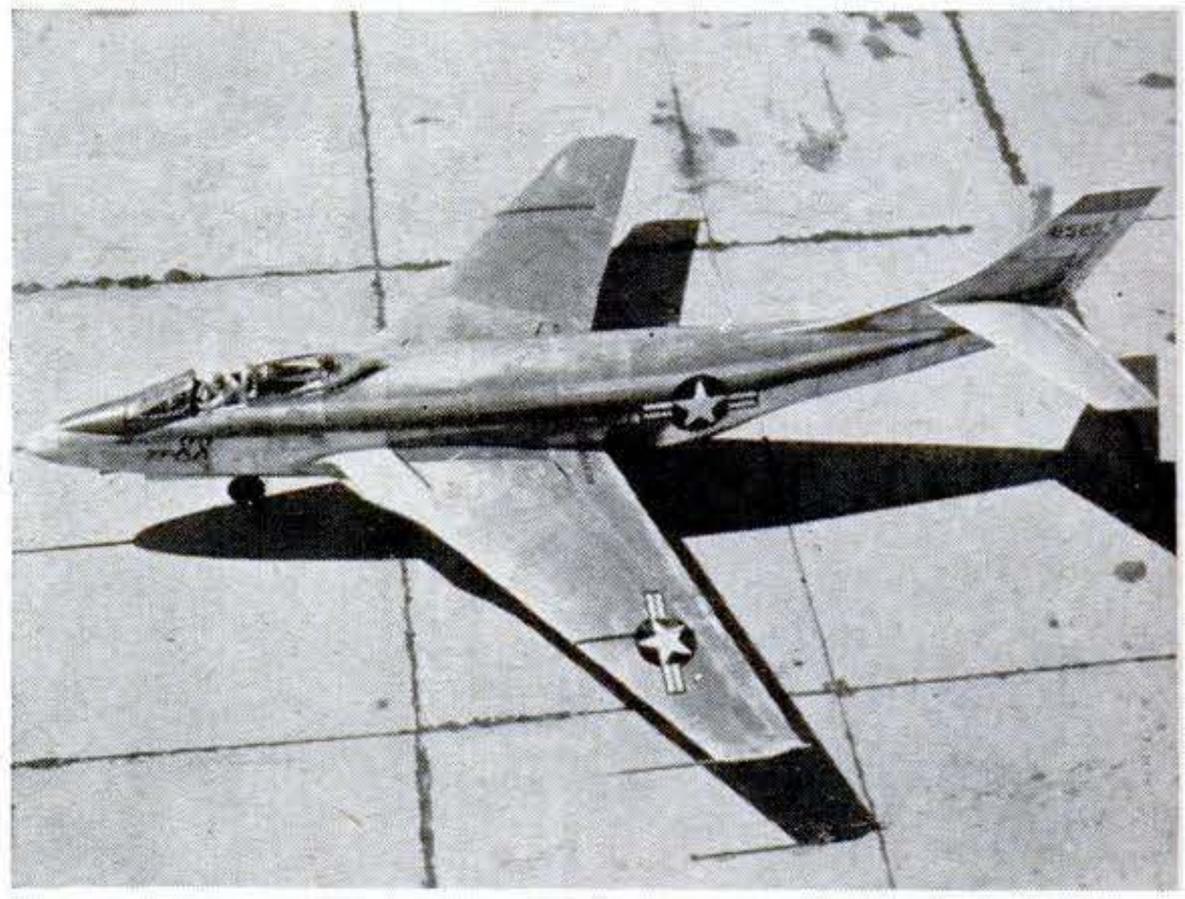
The Russians have planned most of their air force as defensive and offensive support for the immense Red army. For a time this planning was at the expense of a strategic section capable of delivering bombs on a distant enemy. This no longer is true. Today the Russians are as much alive to the need for long-range bombers as we are.

The Red *jet* air force is not, of course, designed for strategic air warfare—for flying thousands of miles to deliver a load of bombs on an industrial target to quench an enemy's capacity for producing war materials. Jets don't have that range. Like ours, the Red jets are for relatively short-range flights—for the defense of their homeland and of satellite nations, and for establishing air superiority over a battlefield.

Sheer numbers make the Red jets formidable. Authoritative reports for the year 1948 gave Russia no less than 16,000 opera-

Counterpart of most famous U. S. jet fighter, Lockheed F-80 (above), is Russian MiG-9 (right). The two planes weigh alike—about 7½ tons—but whereas F-80 is powered by one Allison engine rated at 4,600-lb. thrust, MiG-9 has two Chelomeys. But Russian plane's total thrust just about equals American plane's. MiG's top speed is more than 550 m.p.h. as

U. S. and Russia have comparable ground-support and medium-range jet bombers in 40-ton weight class. North American B-45 (above) has four GE turbojets compared with four Chelomeys in Reds' Il-16 (right). Top speeds of each is over 550 m.p.h.; armament of neither has been published. Span and length of two planes are about the same. B-45, with two en-



First Russian night fighter to be built is La-16 (right), compared here with U.S. McDonnell F-88 (above). Not a heavy plane, La-16 has wing sweepback characteristic of machines capable of transonic speed. F-88 also is fast—Air Force says "over 650 m.p.h." Russian plane's two Chelomey engines, with 4,000-lb. thrust each, are more powerful than U.S. fighter's.

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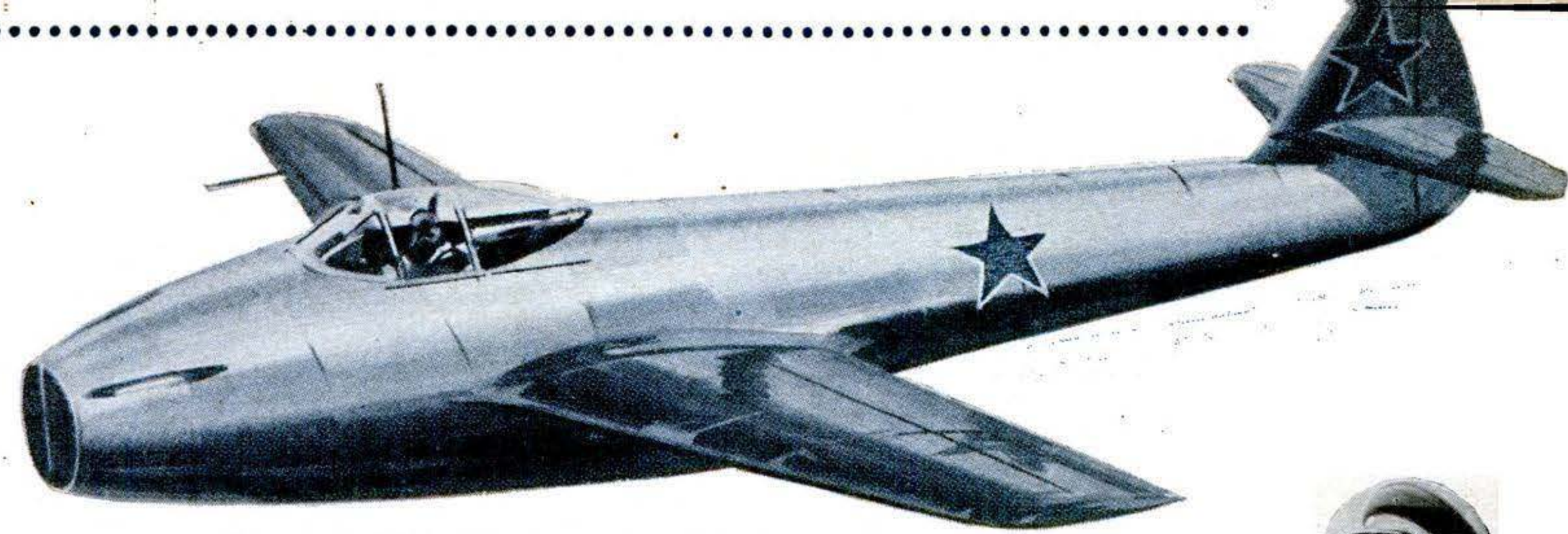
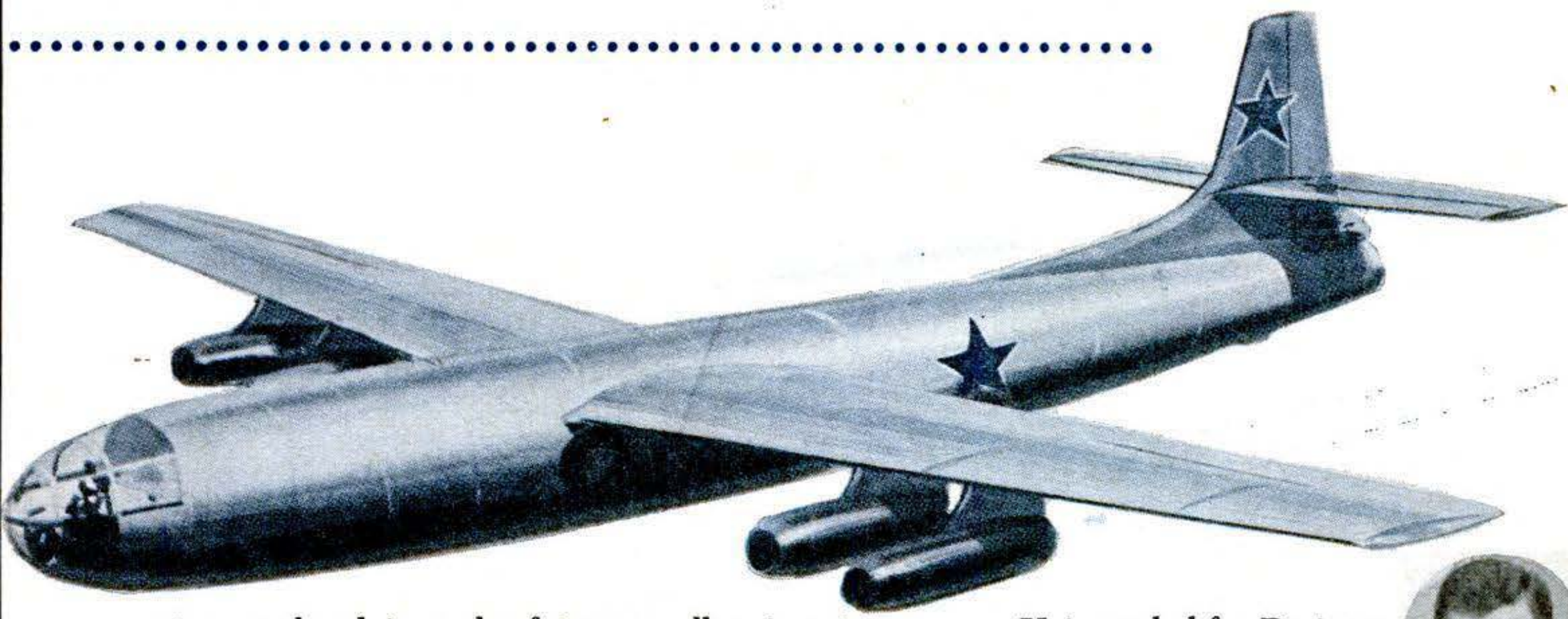


compared with F-80's 580. Armament differs. F-80 carries four 20-mm. cannon, rockets, bombs. MiG totes one 32-mm. cannon, two 12.7-mm. machine guns, rockets, bombs.

MiG stands for designer team of Artem Mikoyen (inset), Mikhail Gurevich.



gines enclosed in each of two nacelles, is not operational in U. S. Air Force. Russian plane, carrying crew of five, is reported in squadron strength. Design was observed as early as 1947.

Il is symbol for Designer Sergei Ilyushin. His best known plane, Il-2 Stormovik, was awarded prize.

Armament is similar: four 20-mm. cannon, plus rockets or bombs. La-16 is a modernization of German Me-362 fighter that was on drawing boards when Nazis capitulated.

La stands for Semyon Lavochkin, designer of plane that won air command over Stalingrad.

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tional aircraft. Of that number, 9,000 were rated as first-line machines. How many were jets is problematical, but the chances are that the number was inconsequential: the Russians were slow to convert to jets.

In 1948 the U. S. had 11,500 operational military planes.

The following year it was a different story. The USSR is reported to have produced 25,000 planes, of which 5,000 were jet fighters. Significantly, they manufactured only 2,500 piston-engined fighters.

We made only 2,500 military planes in 1949.

In 1950, according to the best dope available here, the Russians made fewer planes than in 1949—but a greater tonnage. They, too, are now going in for multi-engined long-range bombers. But it's safe to say that jets figured prominently in the total.

The Reds haven't confined themselves, any more than we have, to single-engine jet fighters. They picked the brains of the German Messerschmitt engineers after the war and adapted the twin-engine Me-262, an outstanding plane, to their own needs.

Reds Also Have Jet Bombers, Attack Planes

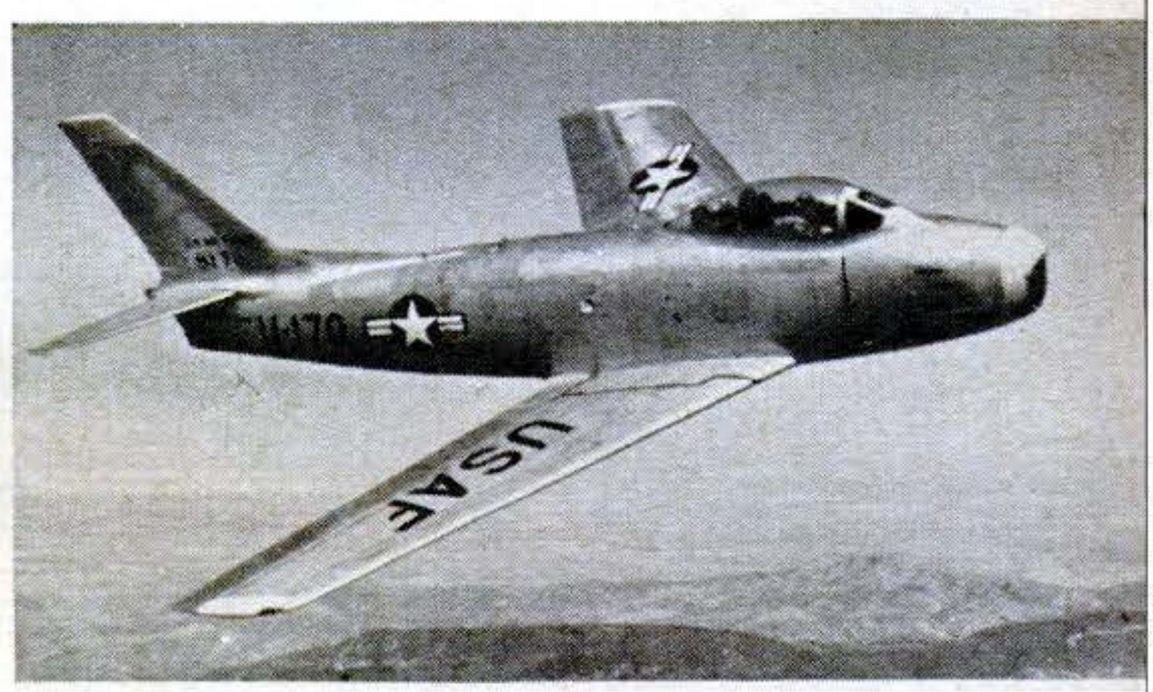
Nor does Russian jet production end with fighters. It covers light bombers and attack planes too. Less is known of them.

The Tu-64, powered by two turbojets, is designed for ground support, but information on its actual performance is meager Its reported top speed of 450 m.p.h. leaves something to be desired. More important tactically is the Il-16, a four-jet ground-support and medium-range bomber. Reported in operation in squadron strength, it compares well with its American opposite number.

In finish and quality the U. S. still leads Russia. But spit and polish alone never won a war. In aircraft design the Reds have nothing to apologize for. They do, however, appear to lag behind the U. S. and England in aircraft gas-turbine design. Russian electronics shows signs of being poor, but an influx of German and Czech technicians should make up that deficiency in time.

Undeniably, in a Soviet air force consisting mainly of fighter aircraft, light bombers, and attack planes the underlying influence is German. In operational theory, it is the organization that a group of German experts, trying to lay the foundation for a future Luftwaffe in defiance of the Treaty of Versailles, created *for the Russians* as far back as the early 1920s. The German influence was accentuated by the importation of German engineers (and some military tacticians as well) after World War II.

Still another comparison is in field of true twin-jet fighters, capable of operation on either of two engines. Russians seized on German Me-262 and adapted it to La-15 design shown at right. U.S. Air Force evaluation teams urged us to do the same, but it was late 1947 before we had a plane equaling German machine in performance. Estimated weight of La-15 is 11,900 lb. compared with about 14,000 for its U.S. opposite number, Navy's McDonnell Ban-



In jet day-fighter category, one of Russia's hottest is Mi-1 (right), using a 40° sweepback on wing—5° more than on fastest U. S. service plane. In performance it compares with North American F-86 above. Speeds of both exceed 650 m.p.h. F-86 is powered by GE engine rated at 5,200 lb. thrust; Mi-1 (widely mislabeled MiG-15), by Chelomey-Nene engine rated at

It was the Germans who ignored long-range bombers before 1939. It was the Russians, as disciples of the Germans, who ignored strategic bombers until quite recently. The Reds, in fact, put Andrei N. Tupolev, dean of Soviet airplane designers, in the doghouse for several years—and at least one factor was his advocacy of long-range bombers. He's back in favor now.

If the predominant influence on the Russian jet air force is German, for our own safety's sake let's not sell the Russians short. The Germans were pretty good. END

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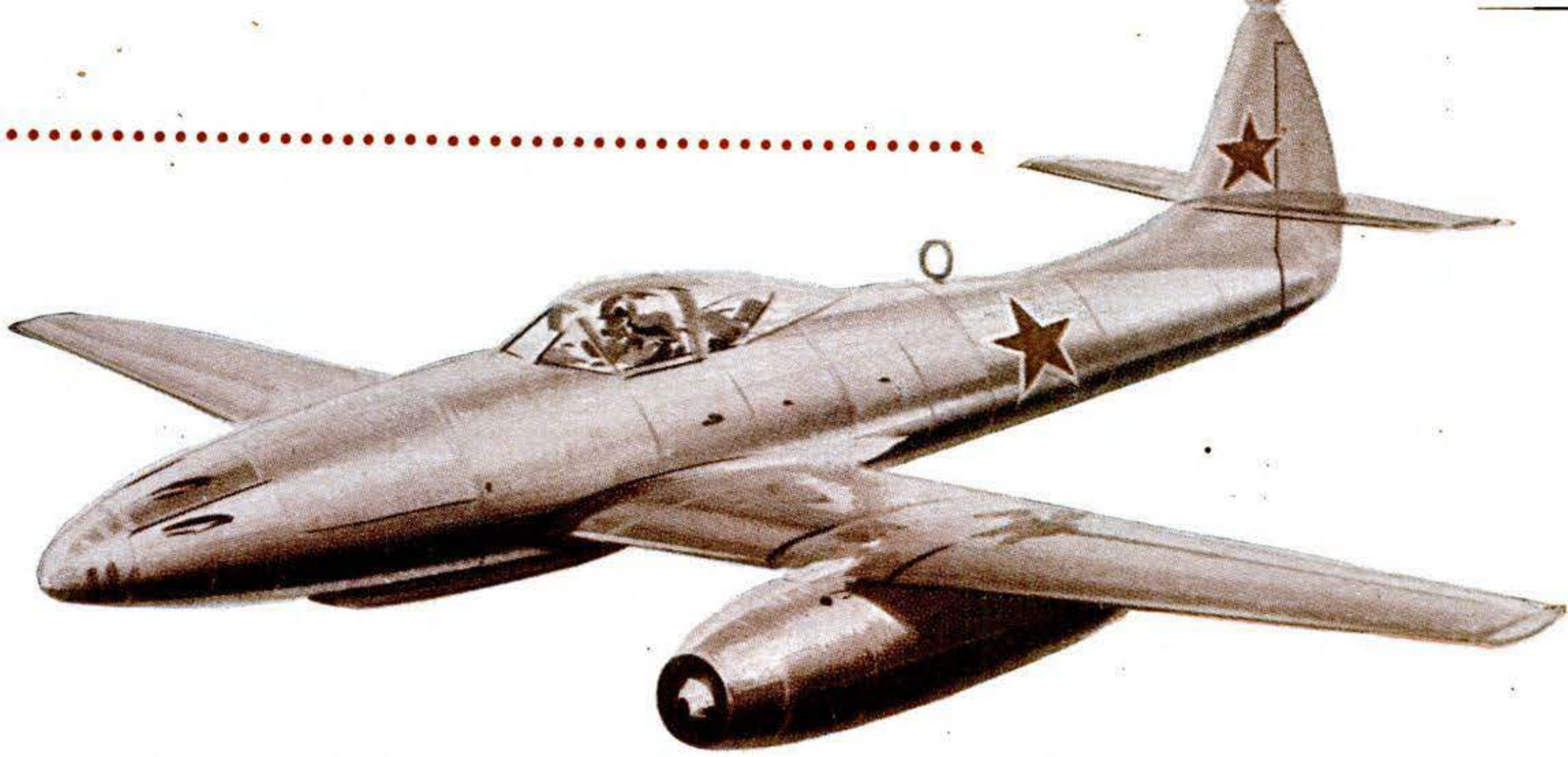
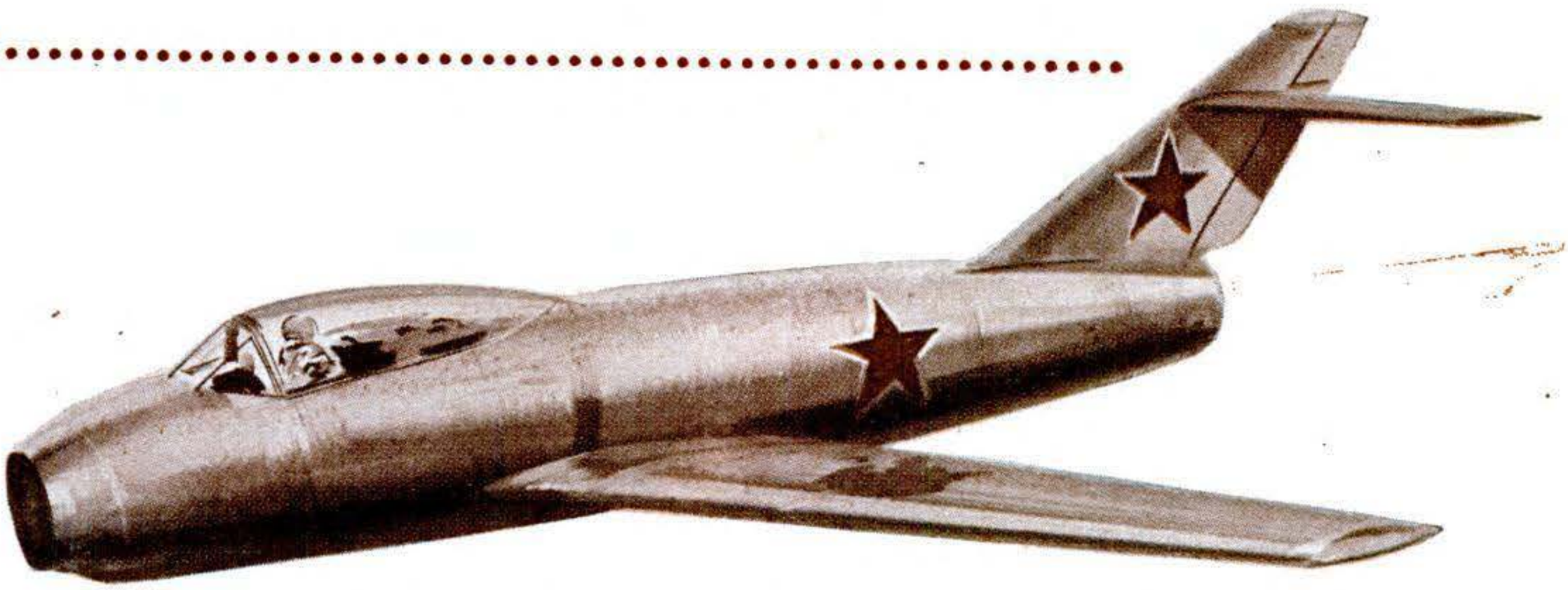
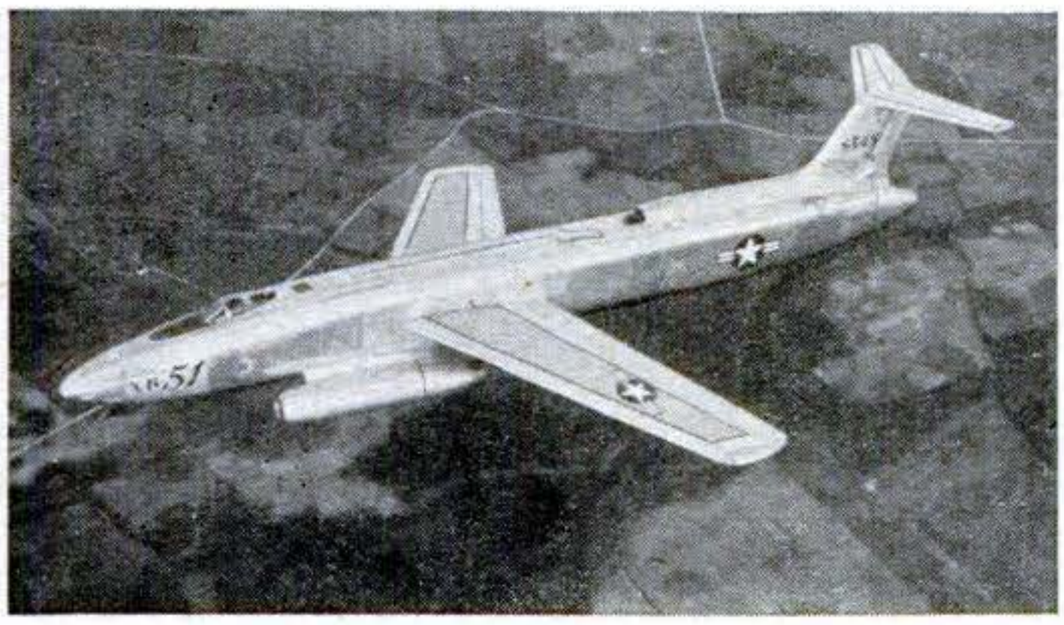


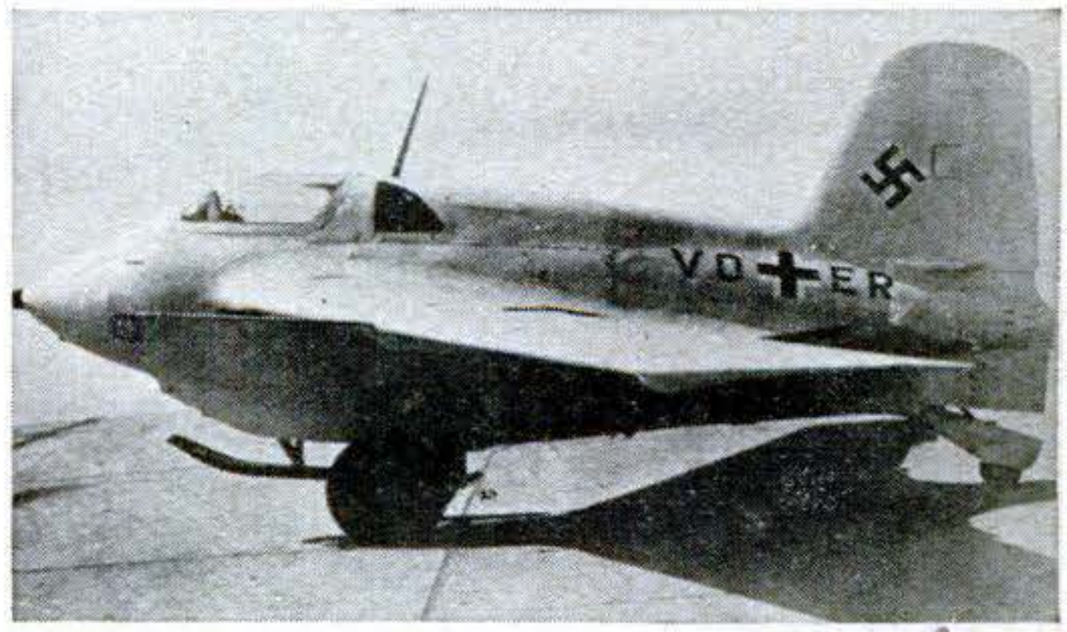
shee (left). La-15's power is two Chelomey axial jets of 3,700-lb. thrust each; Banshee's is two Westinghouse J-34 jets rated at 3,000 lb. Top speed of both planes is over 600 m.p.h. Armaments are secret. Czechoslovak publication *Letecvi* indicates La-15 has system for restarting engines in flight. U.S. is said to also have a system for re-firing jets.



5,500-lb. thrust. Red plane's armament includes two repeater-type launchers for 40-mm. rockets. F-86's is four 20-mm. cannon, plus rockets and bombs. Russian rocket launchers can shoot spin-stabilized, 40-mm.-diameter rockets in rapid succession. Recently it was disclosed that U. S. has developed repeater rocket tubes for operational aircraft.



Martin B-51, a three-engine plane of exceptional performance, is more truly representative than B-45 of ground-support jets in U.S. The B-51 is not yet operational, but Russians have nothing like it. Their nearest plane is two-engine Tu-64, reported to have a top speed of only 450 m.p.h. Red plane is a variant of propeller-driven Tu-2, which carries bomb load up to 2½ tons.



U. S. has nothing, on the other hand, like Russians' Yak-21, developed from German Me-163 rocket interceptor (shown above)—used by Luftwaffe to attack our Flying Fortress formations. Russian rocket-driven planes are reported assigned in moderate strength to local defense units. Capable of transonic speeds, engines use fuel mixture of gasoline and nitric acid.

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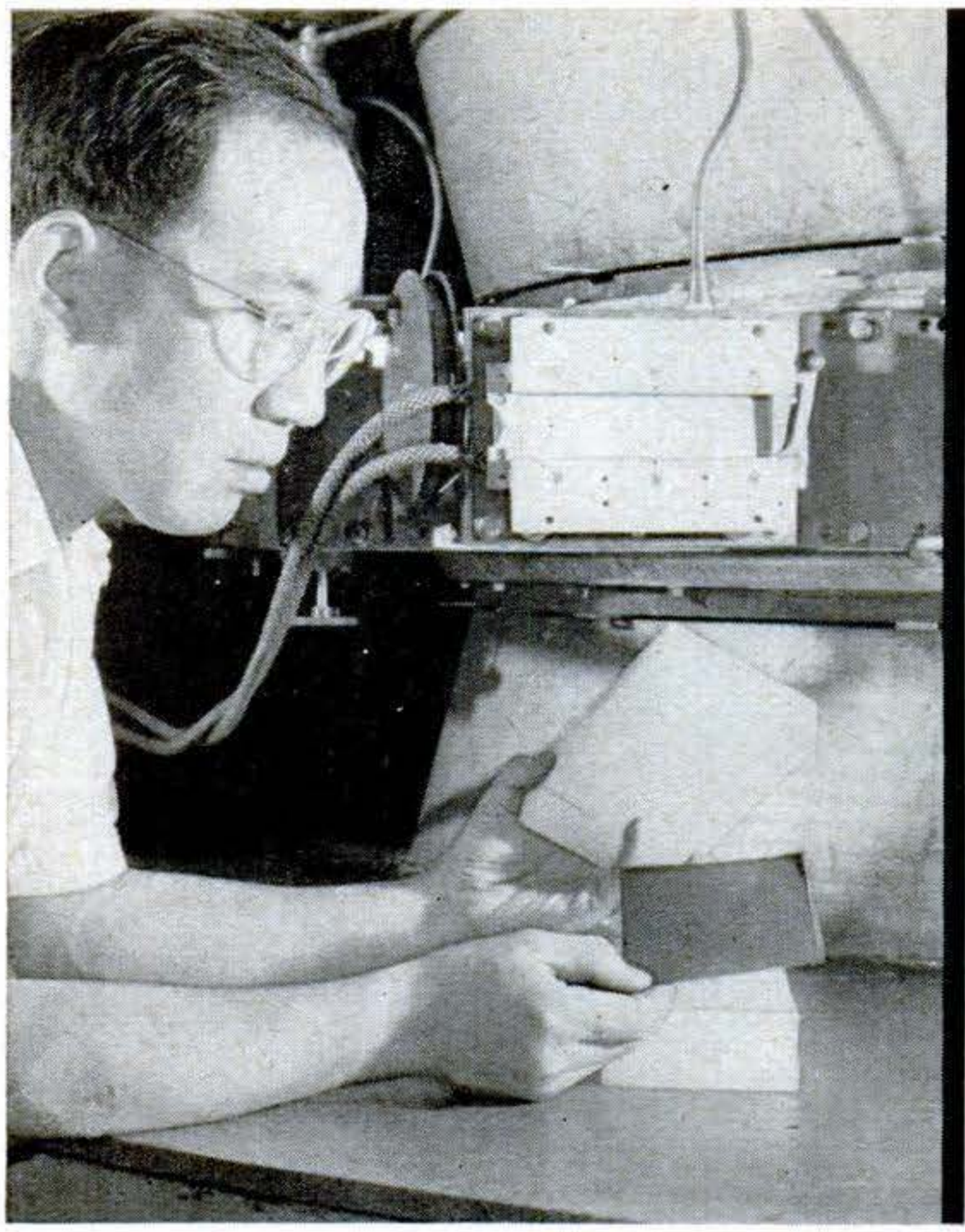
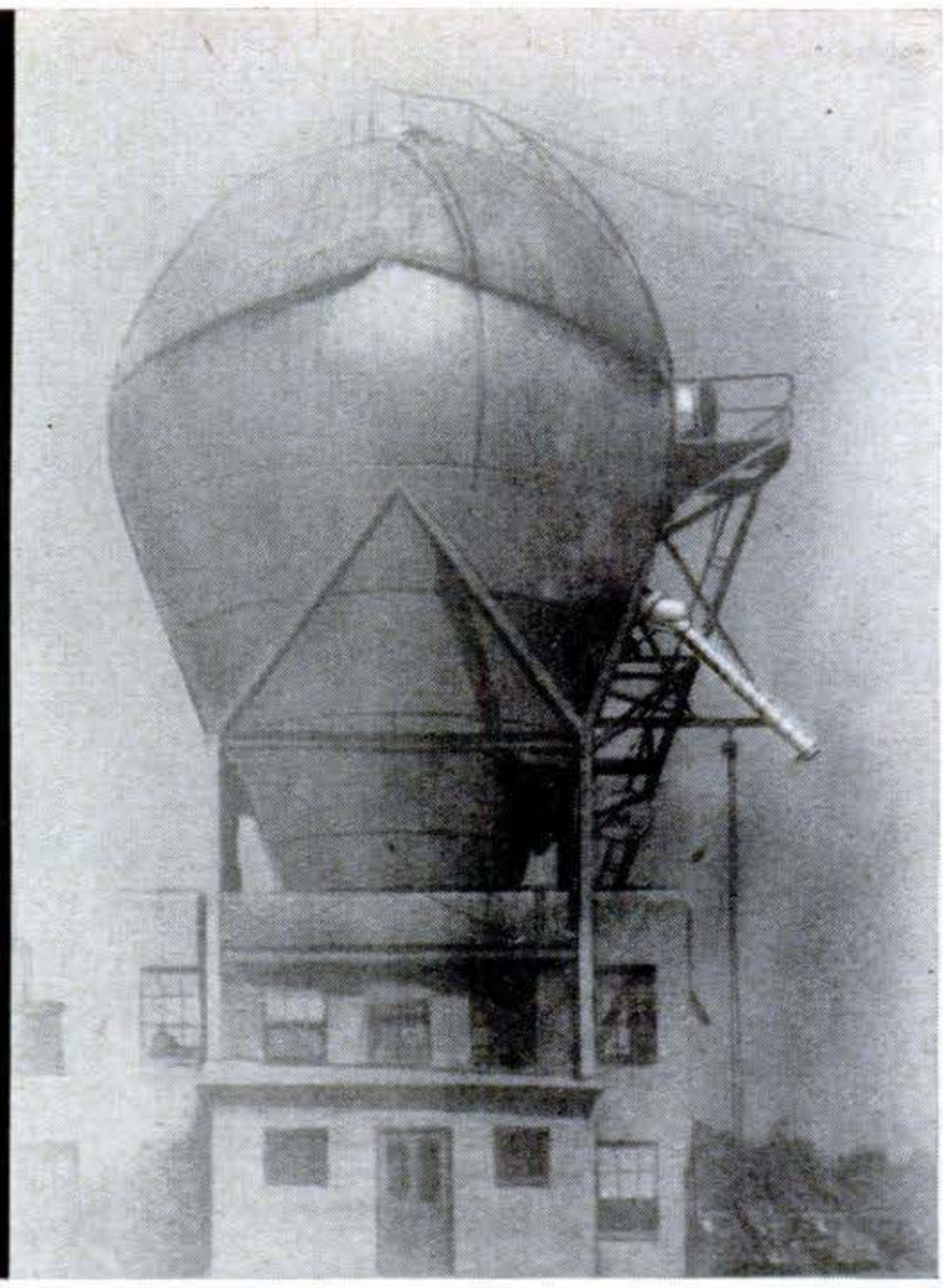


To "print" with atomic rays, Dr. Sun places transparency between wax blocks, puts this in cyclotron. Neutrons from cyclotron, slowed by wax, make photo's silver atoms radioactive.



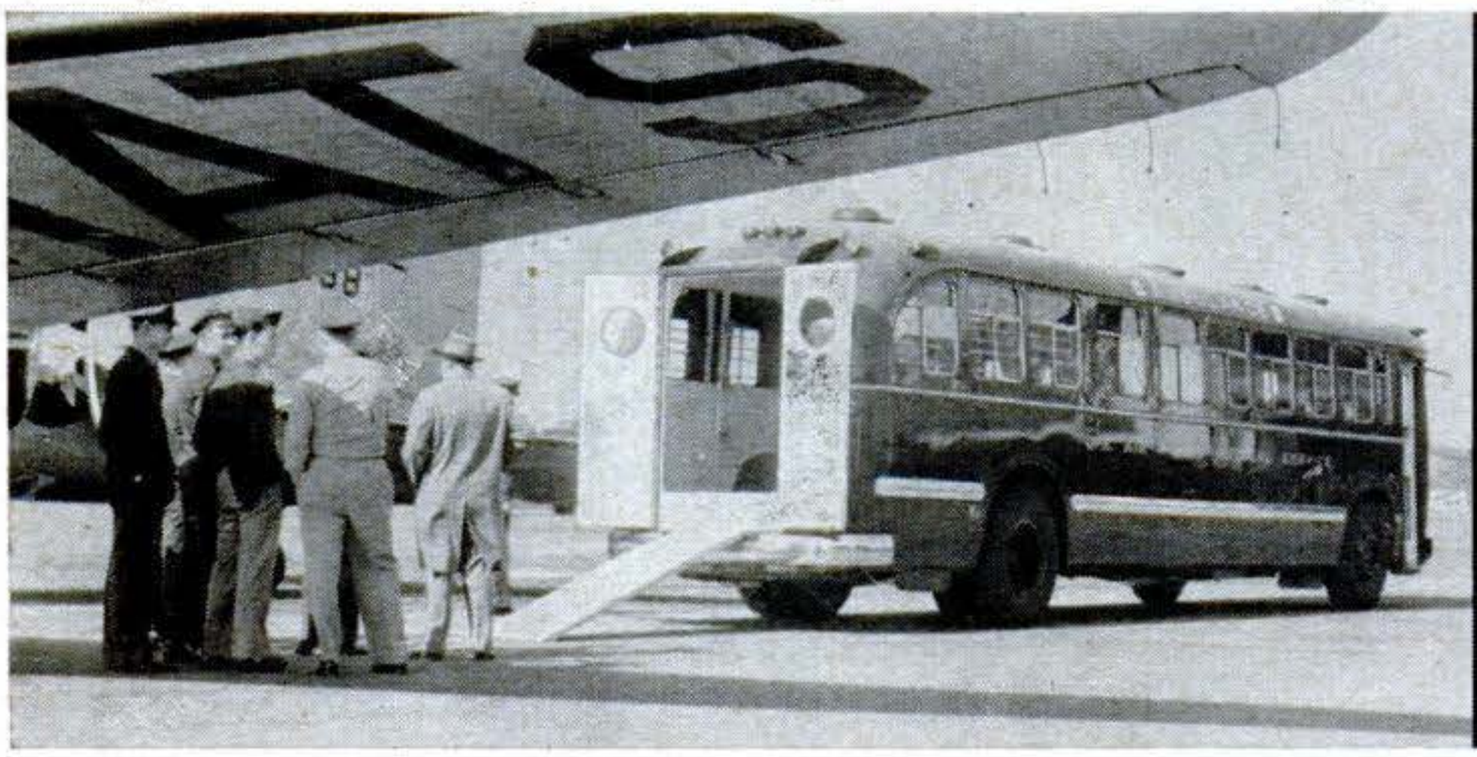
This is an "atomic print," made by holding radioactive transparency against printing paper. Since ordinary photo paper is blackened by radiation, the positive copy above is the result.

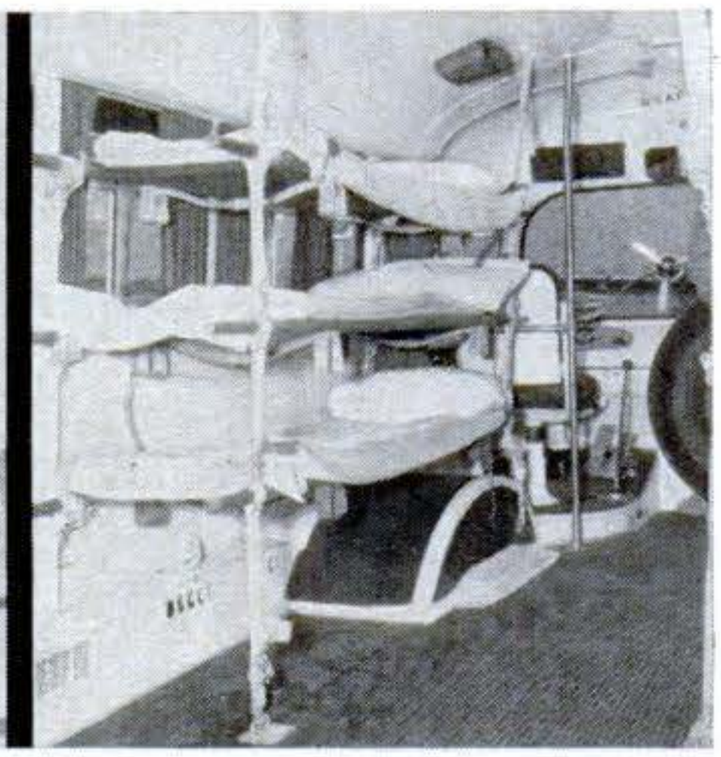
Photograph "Printed" by Rays of Big Atom Smasher

PHOTOGRAPHERS have a new way to copy pictures now. Not that many are likely to adopt it—they'd need a cyclotron. But Dr. Kuan-Han Sun, Westinghouse physicist, had one of these huge atom smashers handy, and he used its rays to print the picture at right above, probably the first of its kind.

Dr. Sun placed a positive transparency—made in the ordinary way—inside the University of Pittsburgh cyclotron. Bombardment with neutron particles made the silver atoms in the transparency mildly radioactive. When placed against a sheet of printing paper, the "hot" transparency "exposed" the print. Since radiation darkens photo paper, a positive print results.

Army Converts Inter-City Buses into Big Ambulances





SIX inter-city buses already on the production line have been transformed into giant ambulances for the Air Force. The rush job—completed in six weeks—was engineered by the Army Ordnance Corps. The big ACF-Brill buses were fitted with rear doors (above, left) to simplify loading from planes. Each carries 18 litters (right).

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Reel Removes Bomb's Fuse Safely

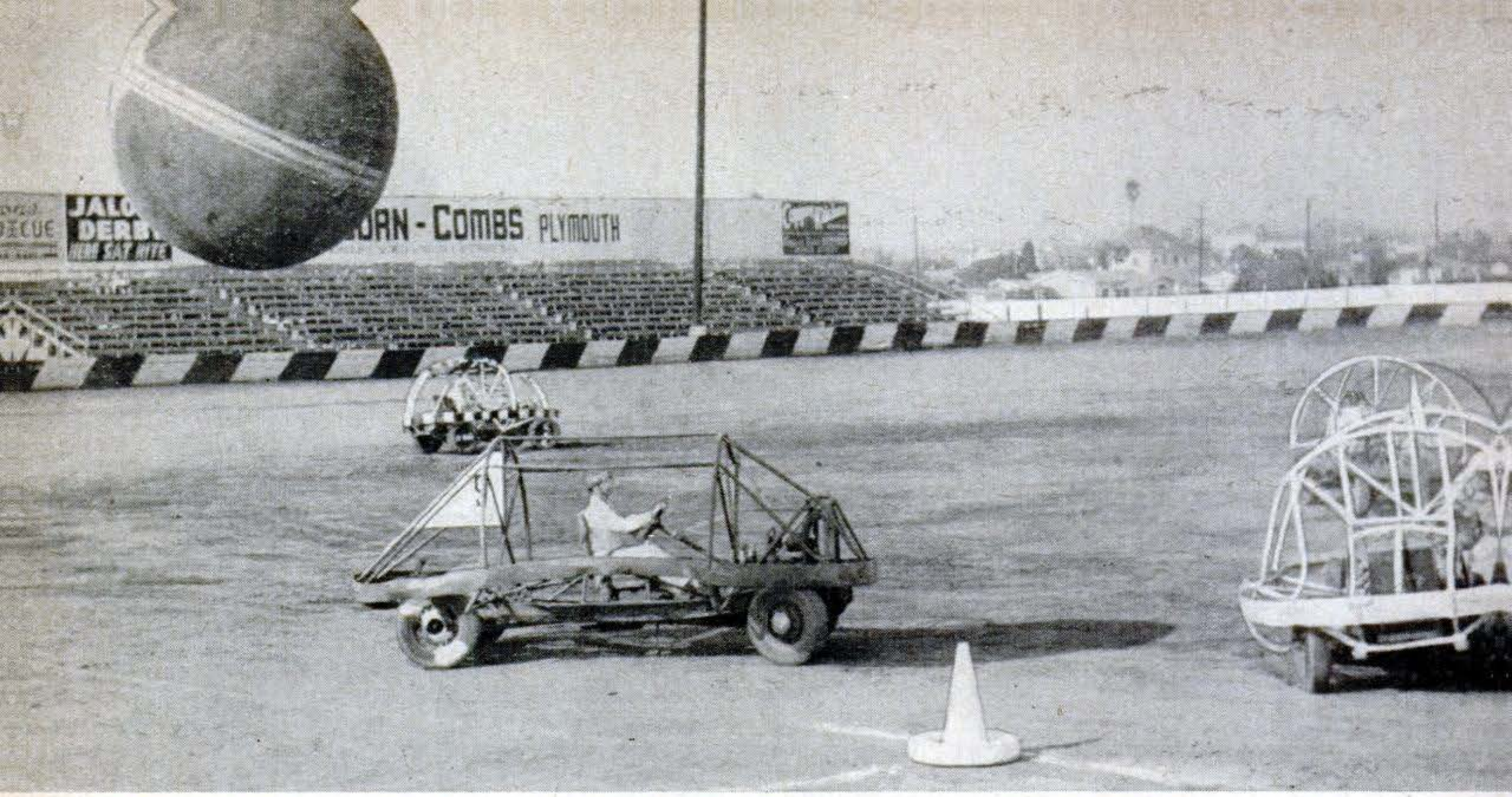
THE circular device being attached to the bomb above by a West Berlin police officer is a new defuser that takes some of the danger out of disposing of unexploded bombs. After it is fastened to the bomb's fuse, the operator—from a safe distance and in a protected location—pulls on a steel wire wound around the drum. This spins the drum, unscrewing the explosive tip. If the fuse goes off, no one is hurt.

Detachable Roof Converts Convertible to Winter Hardtop

THIS lightweight, auxiliary roof quickly converts a convertible into a hardtop for rough winter weather. After the car's regular top is lowered, Add-A-Top is lifted into place and bolted on, using existing holes. Made of rigid Fiberglas, the top has a large plastic rear window. It can be installed in five minutes. Rubber insulation around the edges seals out wind and rain. Add-A-Top Co., of Detroit, makes it in several sizes.

Tree-Eating Truck Helps Linemen

A TREE-EATING truck, used by crews of the Ohio Edison Electric Co. for trimming trees along power lines, simplifies the job of disposing of bulky brush. As men cut branches, others feed them into a hole in the side of the truck. Inside, three rapidly revolving steel blades chew the brush to shreds. The chips are then blown into the bed of the truck for storage and later disposal as mulch.

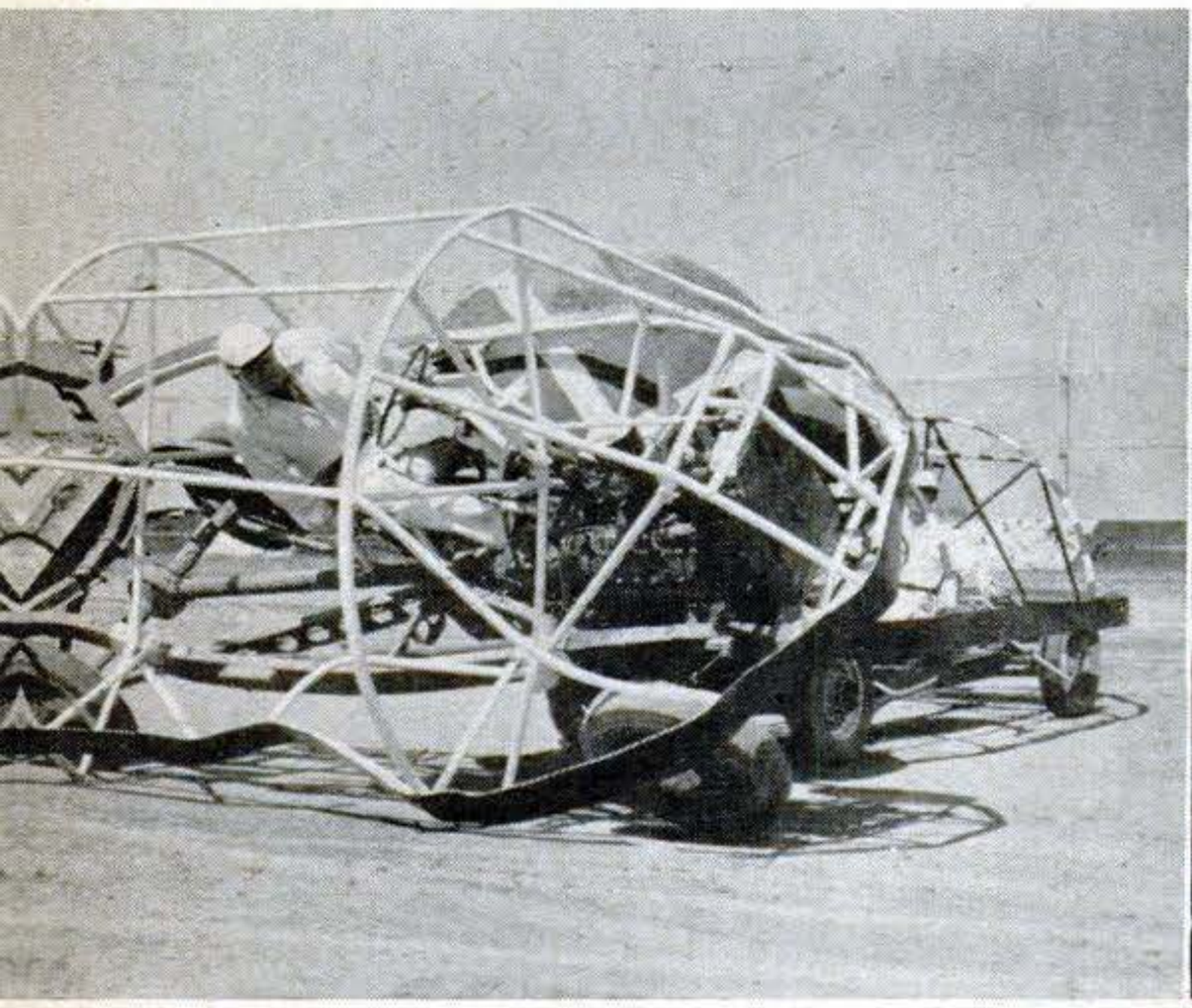


This is polo the way B. J. Goodman and his California "Moto Polo" teams play it. Cut-down Fords replace the ponies; a 173-pound rubber ball subs for the traditional small white one.

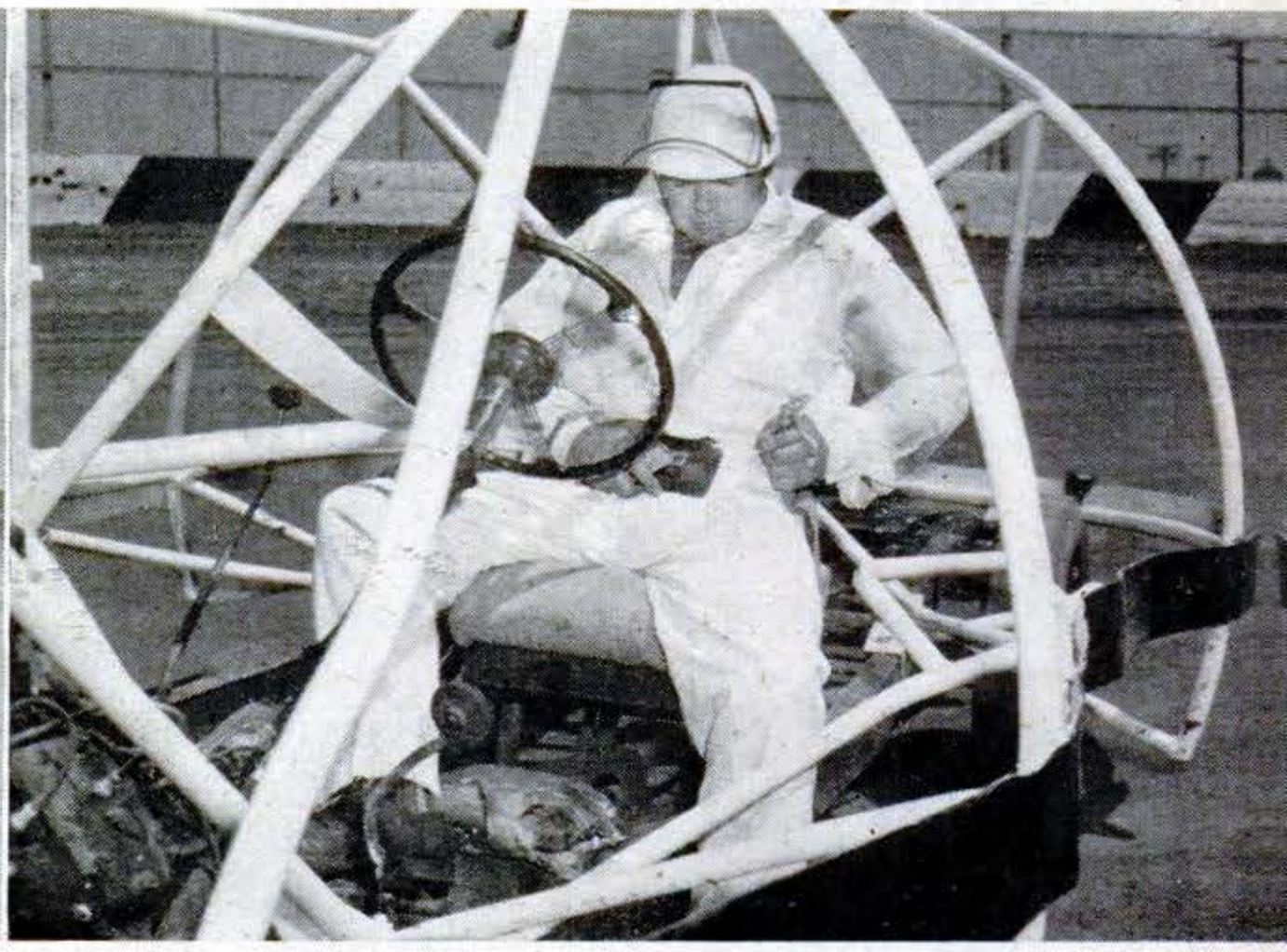
Hot Rods Play Polo

POLO, the 2,000-year-old sport of playboys and princes, has been taken over by the hot-rodders. In California, four teams are playing a hopped-up version of the game from armored jalopies. They've discarded the mallets and are using the cars themselves to bounce around a 173-pound rubber ball 80 inches in diameter.

Moto Polo, as it's called, is a fast, rough sport. Cars race around the field, sideswiping, colliding, overturning. There are only



Battered No. 5 rolls over when rammed by another car. Referee—whose orders need not be obeyed by players—often does this to enforce a ruling and get a player off the field.



The game is rough, but injuries are rare. Driver has safety strap holding him to seat (above) and rail to grab during upset. A shield keeps battery acid and gas from spilling on him.

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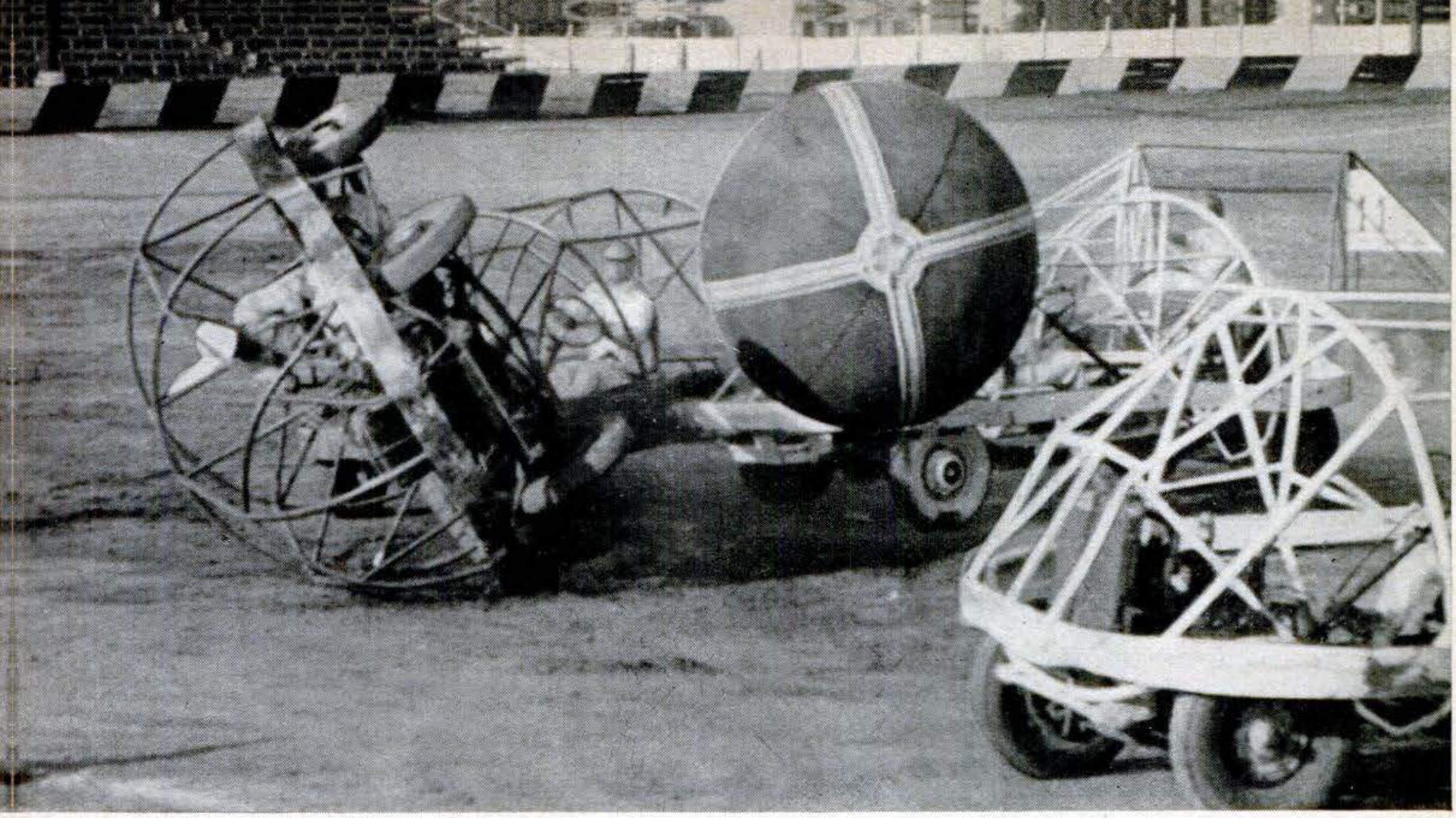
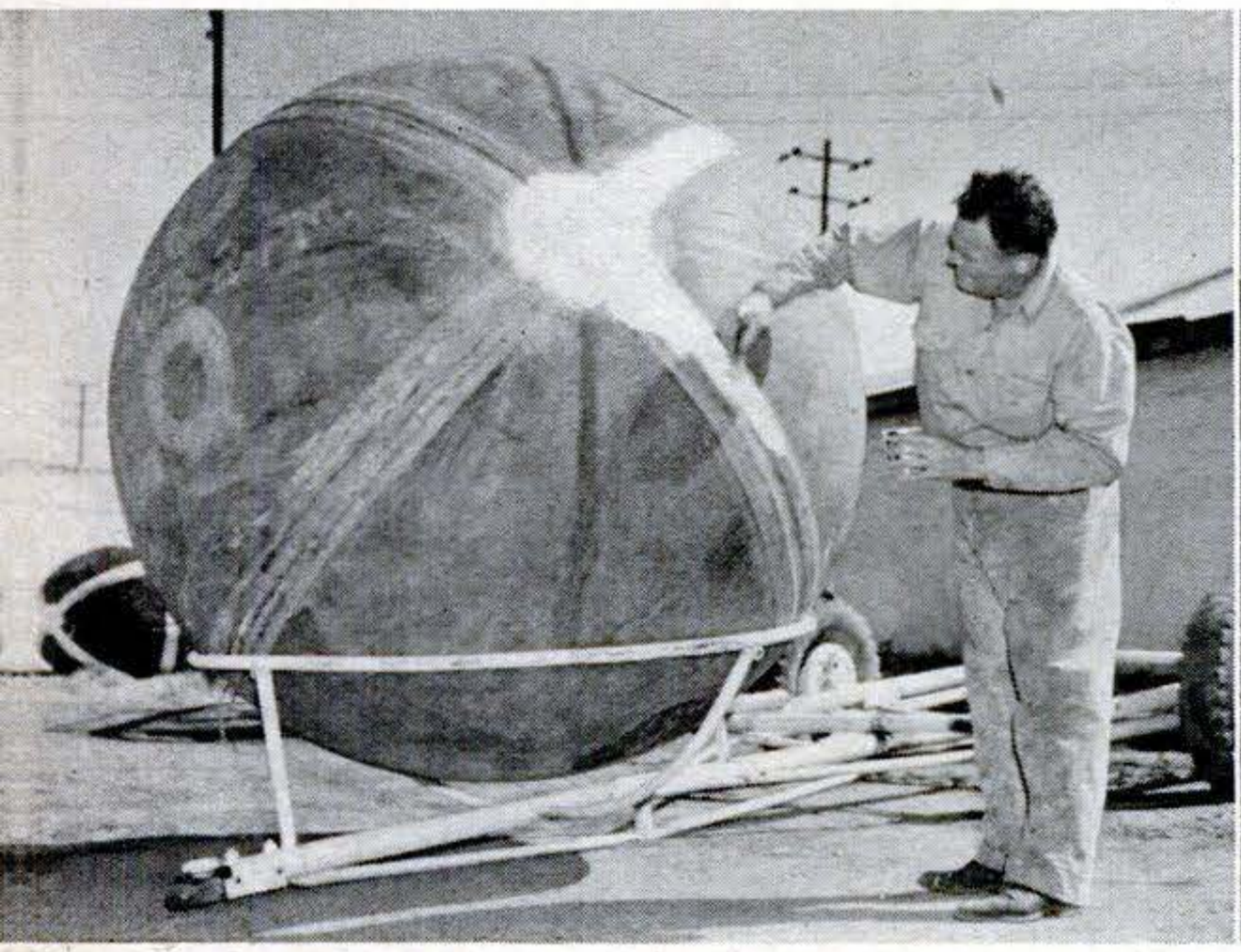


Above you see the reason for the canopy of steel pipe fastened to the jalopies. There are plenty of collisions as players fight for the ball, and the cars roll over regularly.

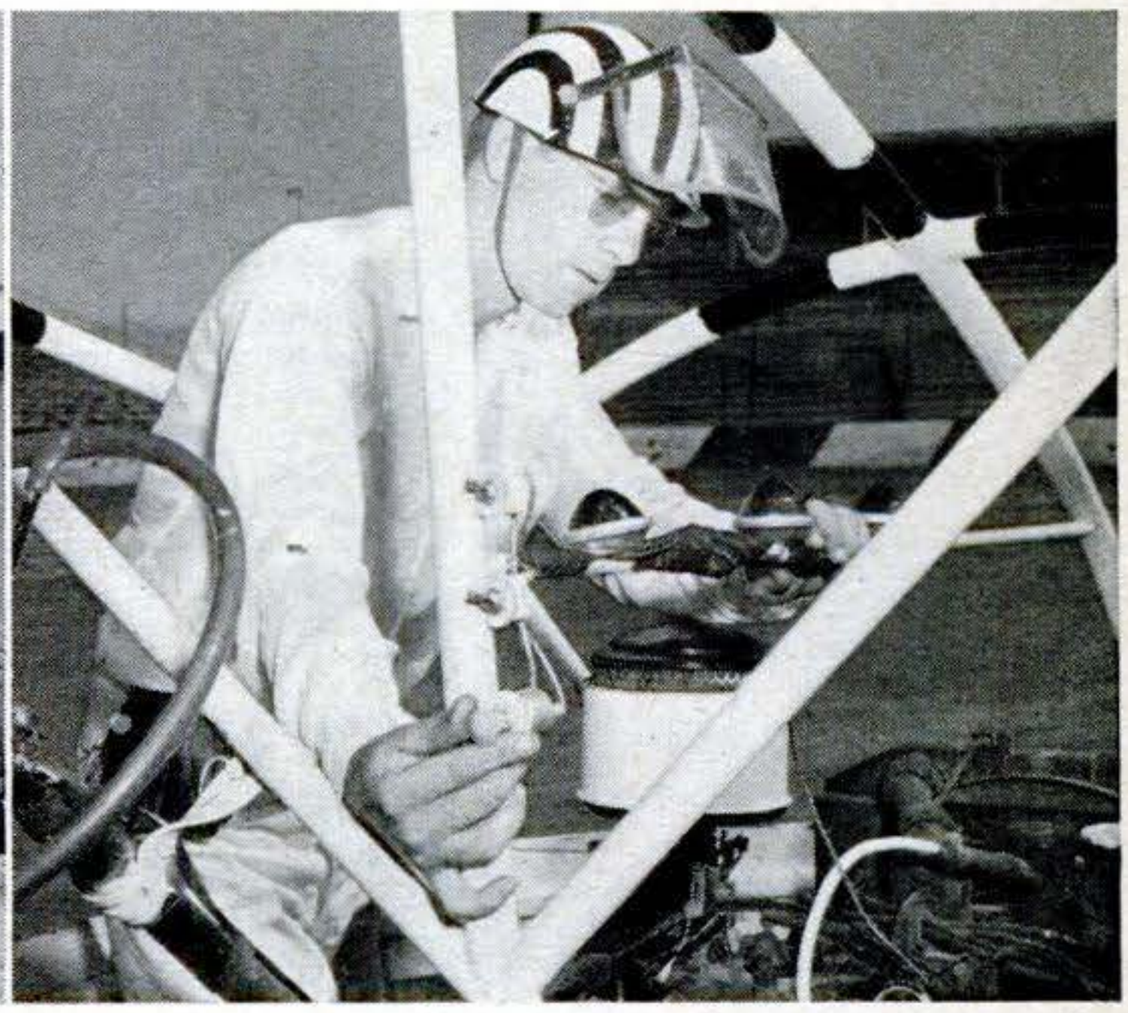
two rules: no head-on collisions, and each goalkeeper must stay on his half of the field. Players don't even have to obey the referee —he must crowd rule-breakers off the field. Yet injuries are rare.

The cars—three to a side, plus a couple of spares—are stock '36 or '37 Fords with standard gearing. But the bodies have been ripped off and replaced with a cage of one-inch steel pipe, welded and bolted to the frame. A tough steel band, eight inches wide and ¼ inch thick, circles the chassis for a bumper. Wire wheels, which take side bumps better than disks, rubberized cloth to shield the driver from spilling battery acid and gasoline, and safety grips and straps for the driver complete the conversion. The referee uses a similarly modified jeep.

These jalopies can do anything a polo pony can—and then some. Careening along in second gear, they can roll over or turn end over end and come up for more. END



Huge ball, striped with white paint for visibility during night games, is nearly seven feet in diameter and costs $65. It rides to meets on the special trailer supporting it in photo above.



Striped helmet identifies the referee (above), who drives an armored jeep. The signal lights tell the timekeeper when a quarter starts, when play is on, and when time is out.

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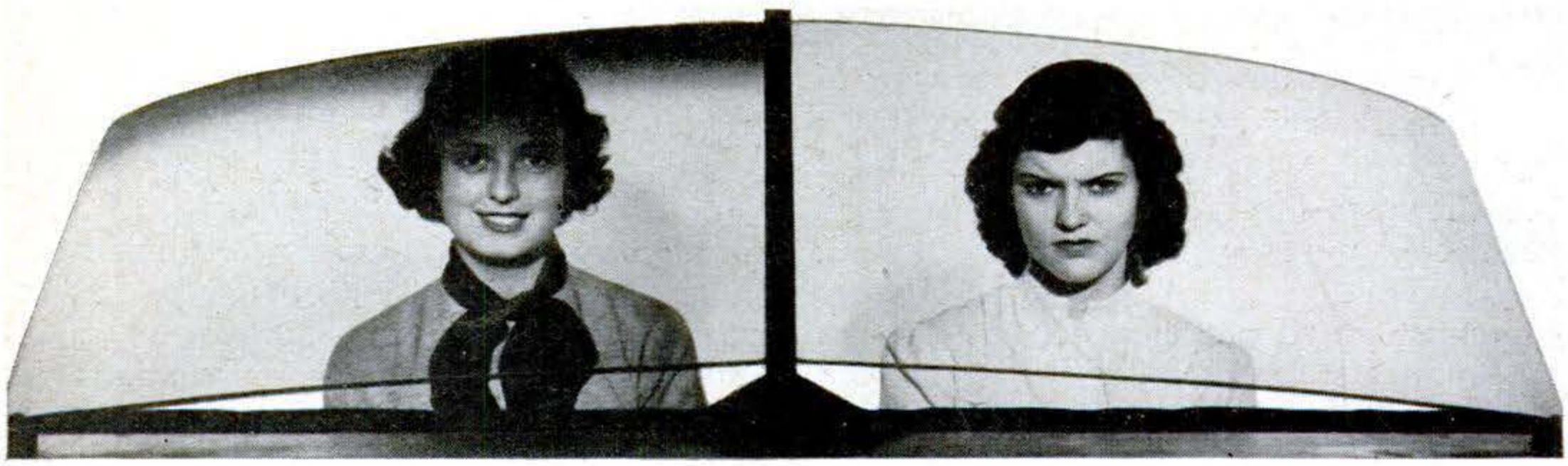
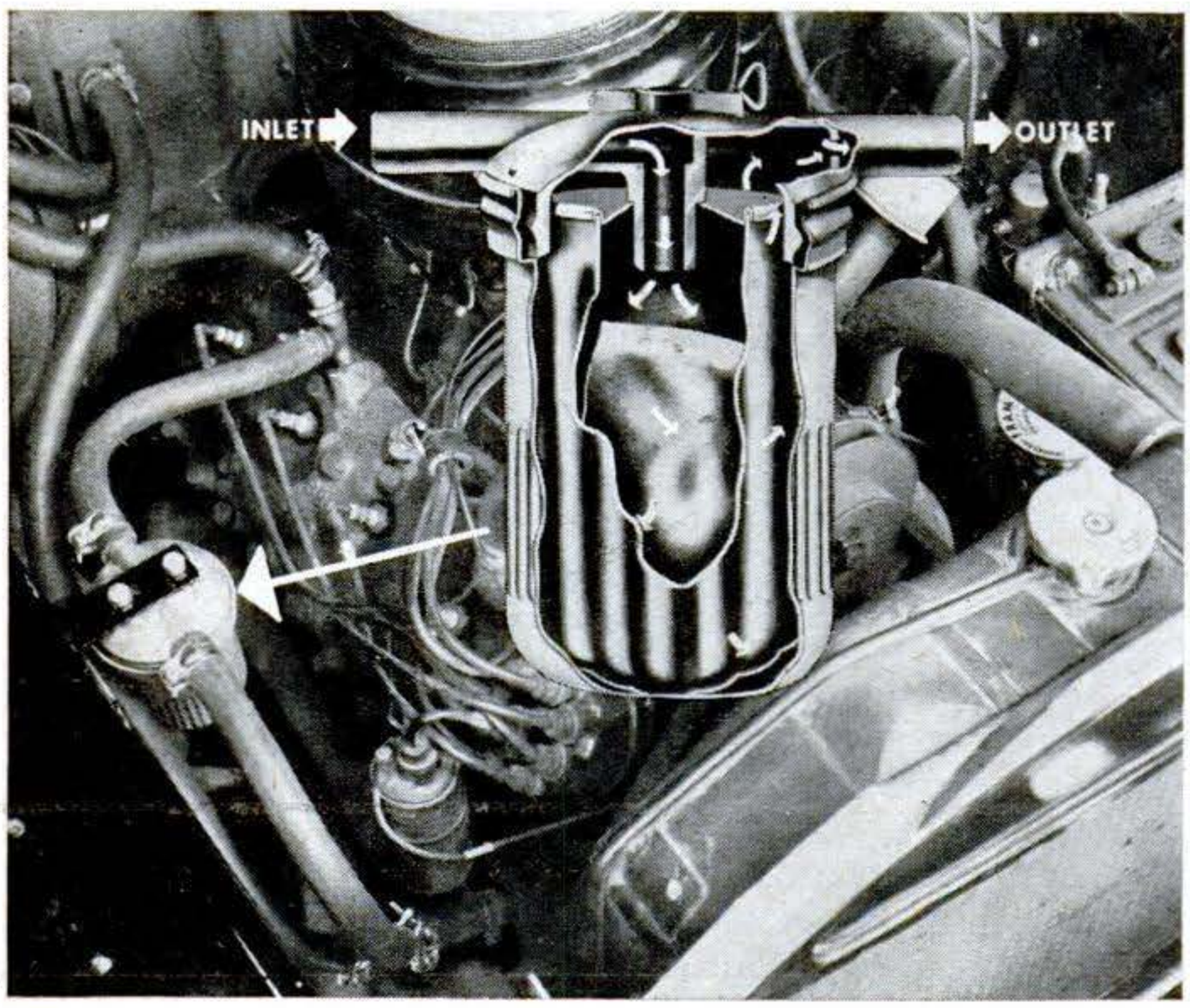
Deck Landing Shows A-Bomb Planes Can Be Carrier-Based

CARRIER aircraft can now wield the A-bomb. Above, for the first time, a plane that can deliver it alights on a carrier deck. The craft is the Navy's new AJ-1 attack bomber; the carrier, the 45,000-ton U.S.S. *Coral Sea,* one of the Navy's three largest. The plane has two piston engines, plus a jet engine aft for extra speed in combat.



"Visor" Built into Windshield

THE shaded windshield at left above wins the decision over the unshaded one, if the girls' expressions mean anything. Optional in Buick's Roadmasters and Supers, the new Libby-Owens-Ford glass has a deepening blue-green tint above eye level. This built-in "visor" cuts out overhead glare and heat. No outside visor is needed.



Car Filter Cleans And Softens Water

HARD water is chemically softened by a new filter for a car's cooling system, preventing scale deposits that cause clogging and overheating. The filter also removes rust and other foreign matter. Shown installed at left, it is normally connected to hot-water heater lines, so that a controlled amount of water constantly flows through a chemical cartridge inside it (cutaway drawing). Made by the Fram Corp., Providence, R. I., the filter retails at $8.14 and replacement cartridges at $1.68.

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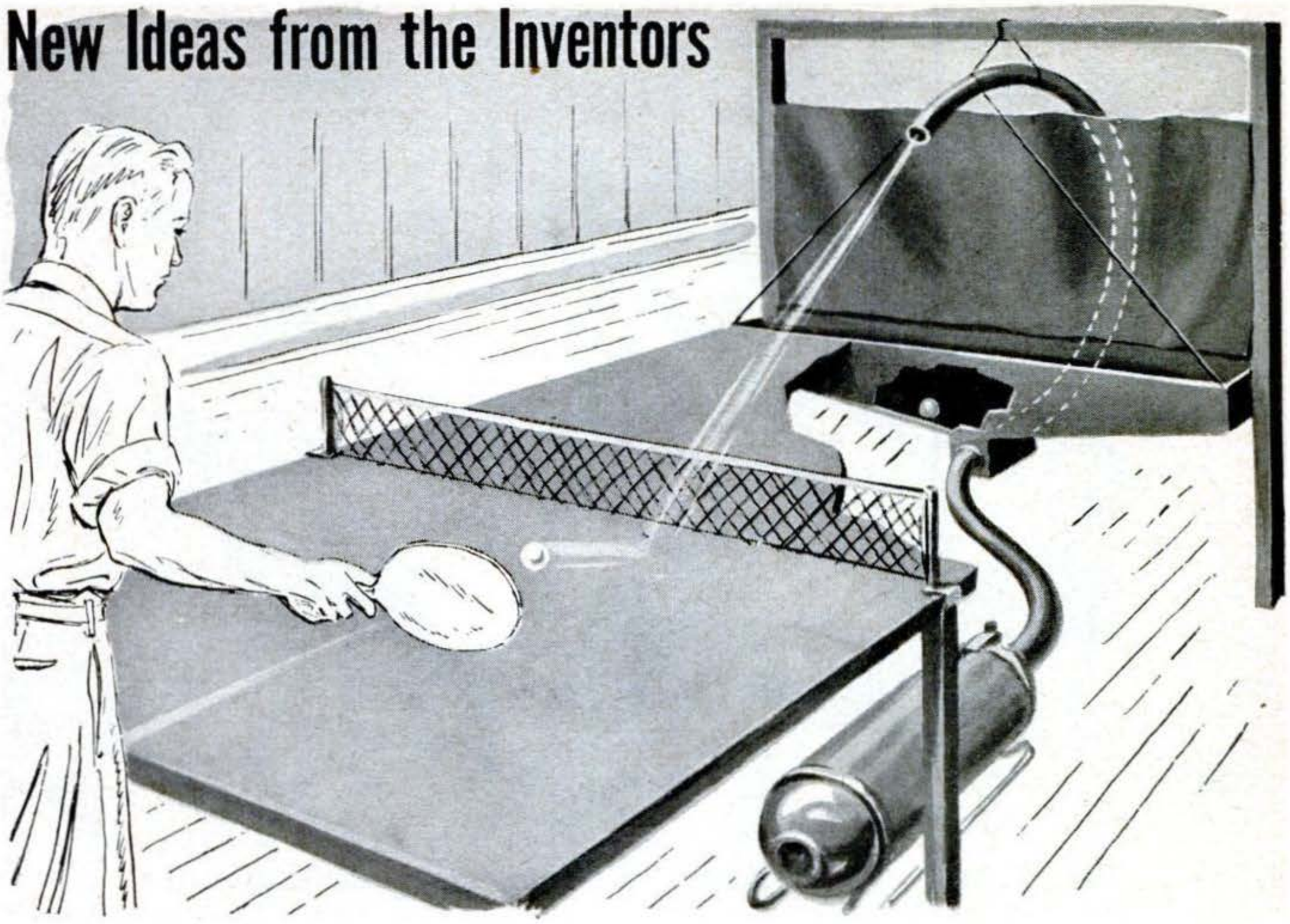
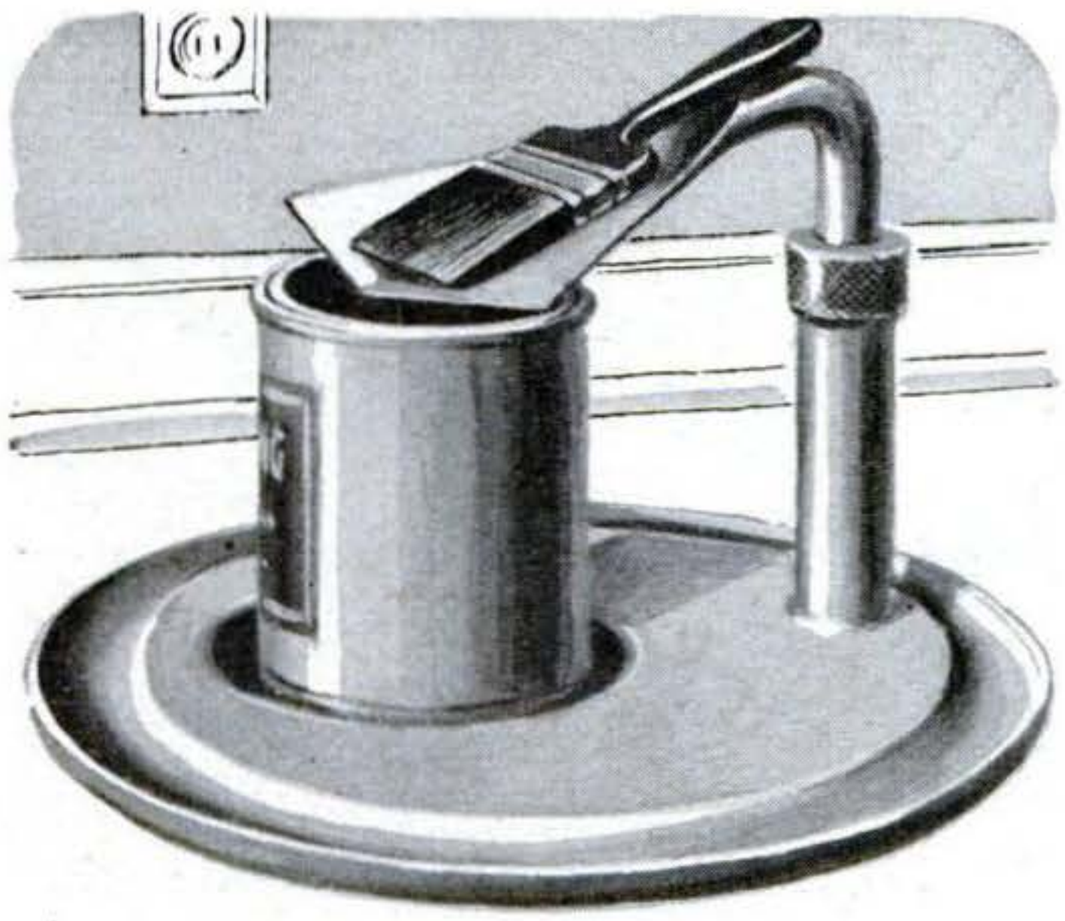
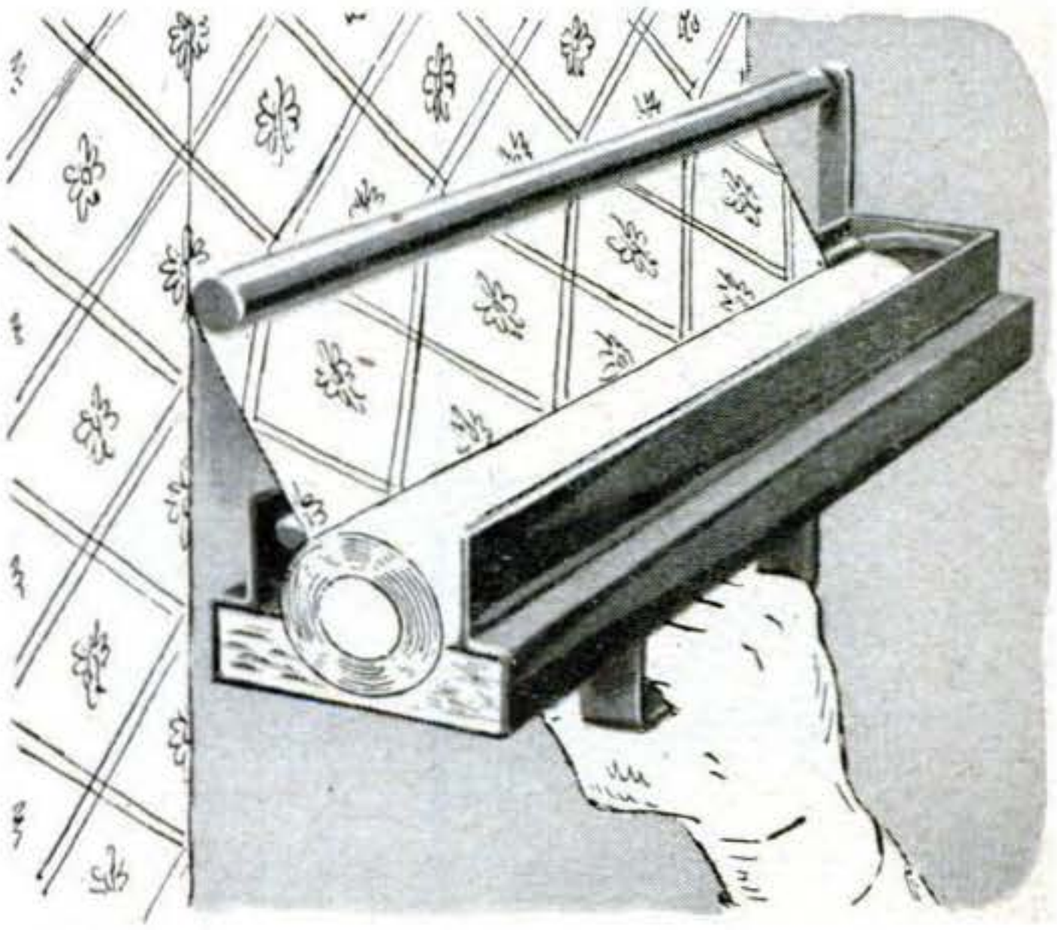
New Ideas from the Inventors



1 Vacuum to Run Ping-Pong Trainer. Set up at the far end of a table-tennis table, this training device is designed to serve up balls to help a player practice returns. Air from the blower end of a tank-type vacuum cleaner powers the unit. Returned balls, falling into a collecting trough, are fed, one by one, into a curved air gun that shoots them onto the table to simulate serves made by an opponent.



2 Can Holder to Catch Paint. A small can of paint would be easier to handle if mounted in this combination can and brush holder. The brush holder, which also serves as a handle, clamps the can down against a traylike base. Any drippings are caught by the base, while the brush holder directs excess paint back into can.



3 Machine to Hang Wallpaper. Wallpaper is rolled onto the walls with this hand-held applicator. The roll of wallpaper, wound wall side out, is held partially submerged in a paste trough. In use, the machine is moved from the top of the wall to the bottom, a roller pressing the paste-coated paper against the wall.

Turn the page, please, for three more new ideas.

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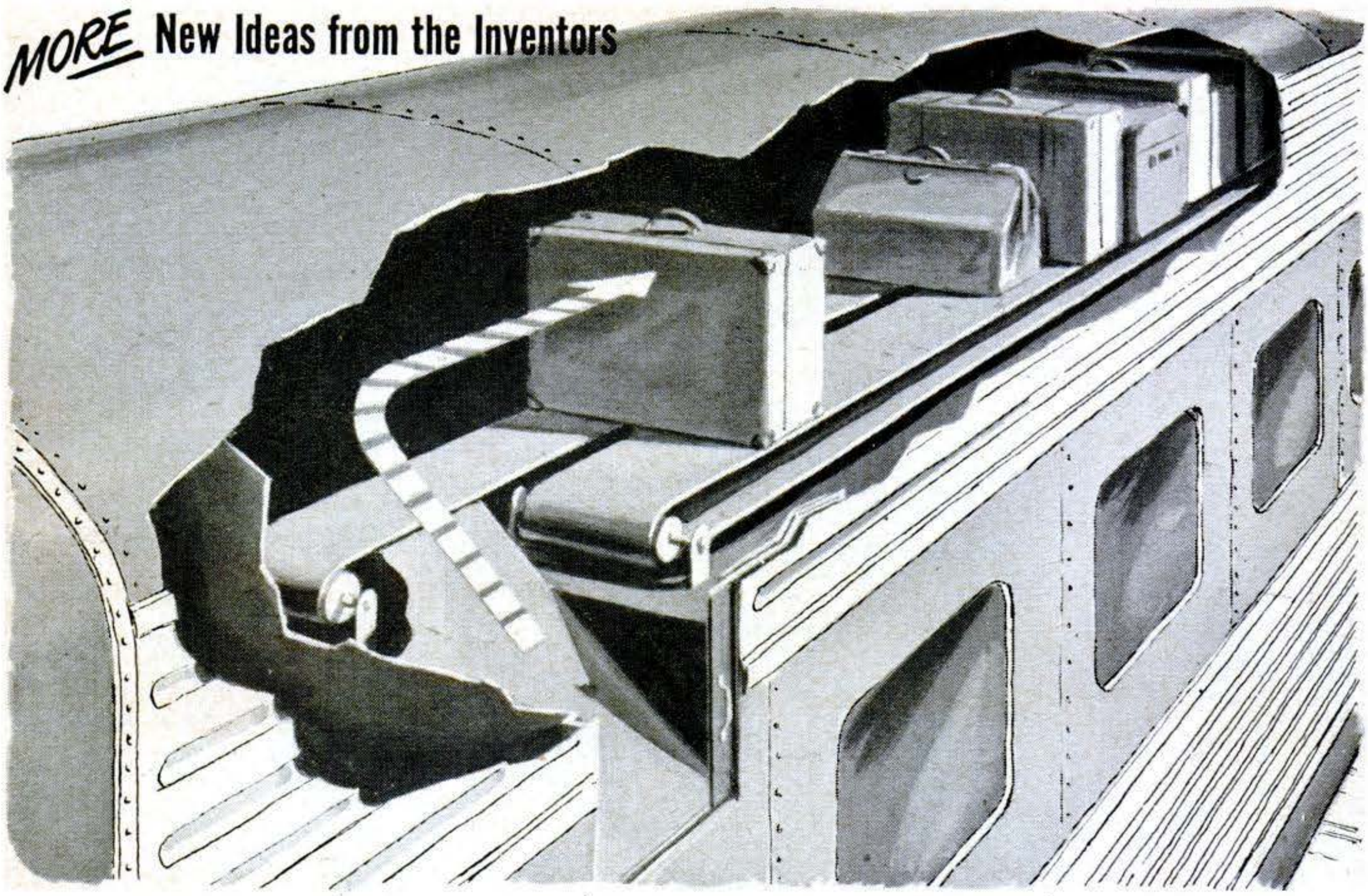
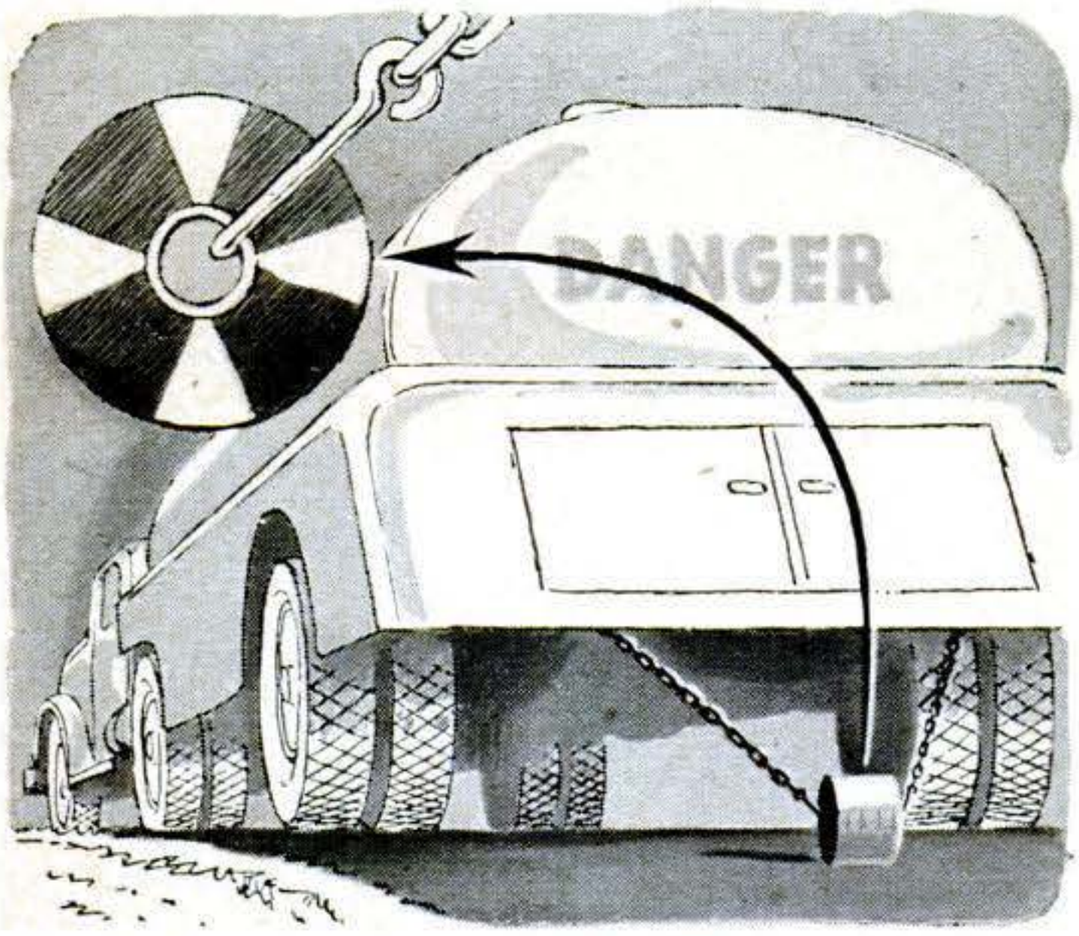
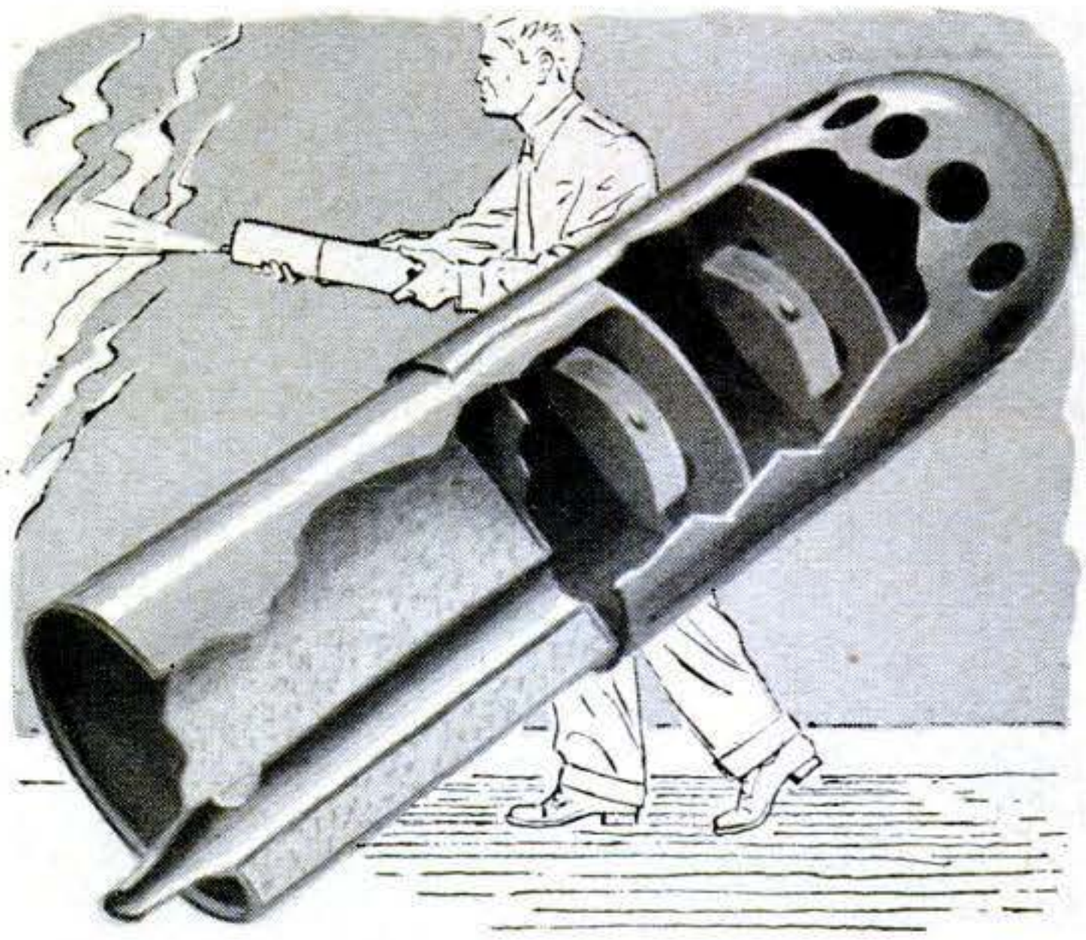
MORE New Ideas from the Inventors



4 Loader to Handle R. R. Baggage. With this automatic baggage handler, luggage is simply pushed up a loading chute near the car door and onto motor-driven conveyers that move it back into an overhead storage compartment. Rearranged later by the porter according to the passengers' destinations, the proper luggage can be discharged at each station merely by operating the conveyer control switches.



5 Roller to Ground Gas Truck. A roller replaces the bouncing metal chain in this grounding device for gasoline trucks. The roller, a cylinder of long-wearing insulating material such as rubber, has a network of metal fingers extending through it to make electrical contact between the truck and the road.



6 Extinguisher to Use Powder. Made principally of heavy cardboard, and using a powdered rather than a liquid compound, this fire extinguisher is designed for low initial cost. Its telescoping tubular body is extended and compressed alternately to operate a bellows pump that blows the chemical on the fire.

Patents on these inventions have been granted to: 1. G. Lemon, Youngstown; 2. M. Worthington, Drexel Hill, Pa.; 3. I. Bodell, Fremont, Neb.; 4. F. Murphy and F. Vander Linden, Chicago; 5. C. Criss, Arkansas City, Kan.; 6. T. Weiss, Oklahoma City, and S. King, Bethany, Okla.

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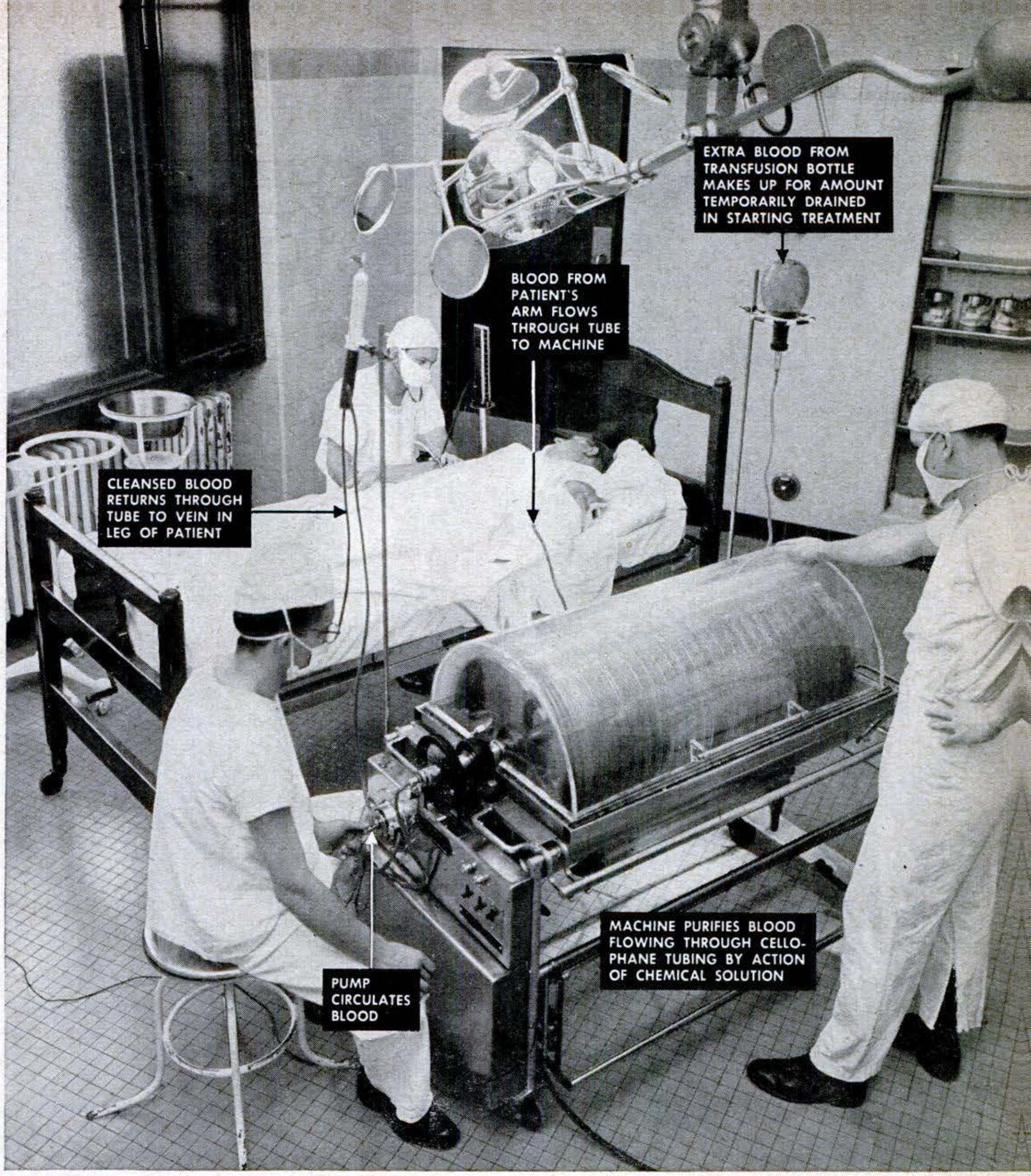

Machine Cleans Blood While You Wait

SENDING your blood to the cleaner's is a modern medical miracle. A device called an "artificial kidney" makes it possible. Latest and most advanced of those in use is the Allis-Chalmers machine above, now saving lives at New York's Bellevue Hospital.

When kidneys quit working, their failure to remove impurities from the blood causes acute uremic poisoning. The artificial kidney provides relief by taking over and giving the organs a rest until they can resume their task. A needle taps a patient's artery, and his blood flows through 125 feet of cellophane tubing on a drum that rotates in a chemical solution. Minute impurities pass from the blood to the solution through the permeable walls of the tubing. Then the cleansed blood is returned to the patient. A treatment takes three to five hours. It causes no discomfort, and no anesthetic is needed.

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Pocket Radio Pages Doctor Night and Day

By C. Ennis

PS PHOTOS BY HUBERT LUCKETT

THANKS to a new radio paging service, physicians in New York City who carry special pocket receivers can be quickly reached in an emergency. A supplement to the telephone-answering services many doctors use, it can tell a physician almost anywhere in the city that an important message is awaiting him.

Under the new system, a patient dials his doctor's number. If the doctor doesn't pick up his phone, the service takes the message. Then, if the message is urgent, the doctor's code number is immediately broadcast on a special radio frequency assigned to Telanserphone, Inc. The doctor hears the broadcast through his pocket receiver, which he switches on at least once an hour to listen to a series of three-digit code numbers. When he hears his number he goes to the nearest telephone to find out where he is needed. Once a doctor responds, his number is taken off the air. Unacknowledged code numbers stay on the air an hour, being repeated every minute. Sixty doctors can be paged at a time with this method.

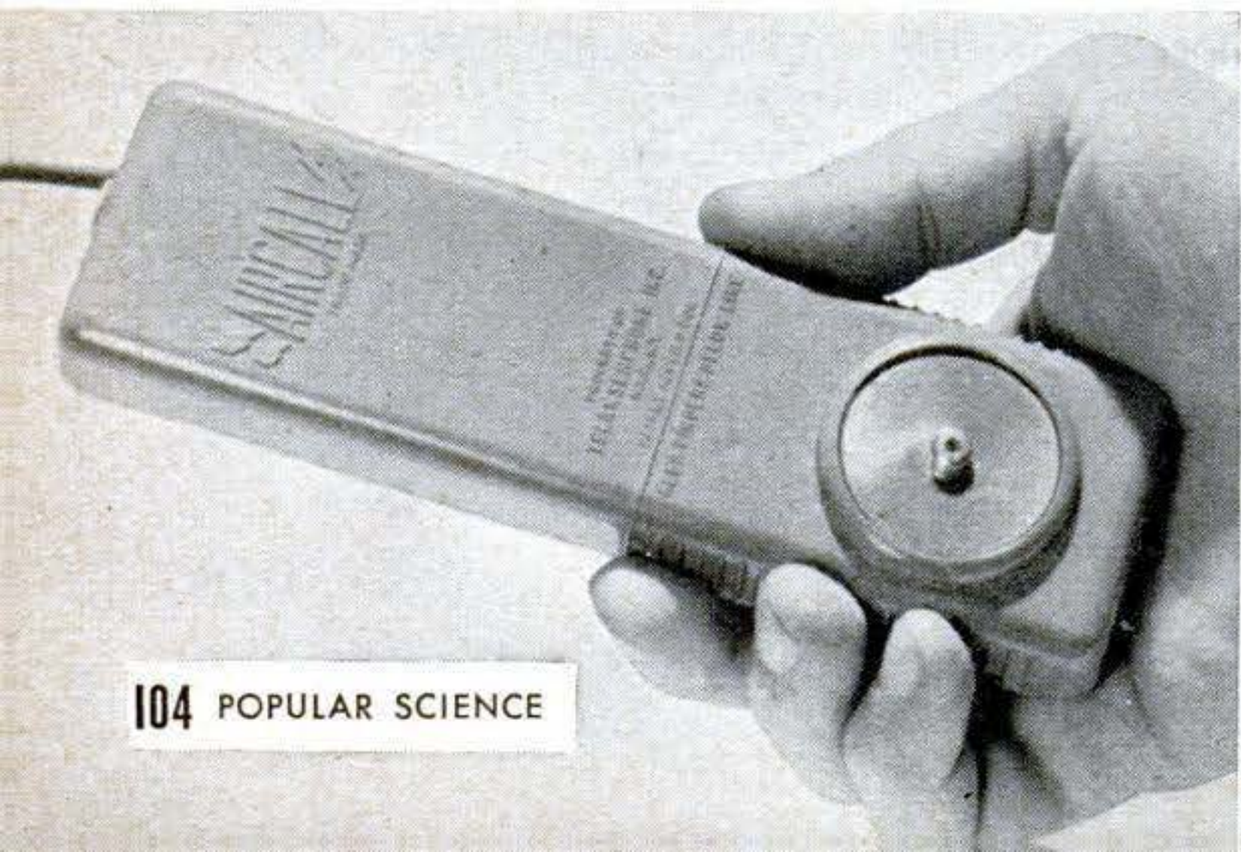
The station that does the broadcasting is KEA627, which operates on a frequency of 43.58 mc. from an antenna 743 feet above sea level.

Code numbers are sound-recorded on 16-mm. motion-picture film and encased in plastic sticks. When a doctor is to be paged, his code stick is hung on the endless moving belt of a special transmitting machine. Then, as the stick passes an electric eye, the number is amplified and broadcast. This machine was developed by Reevesound, Co. Inc., of Long Island City, N. Y.

The doctor's portable receiver weighs only six ounces. It gives good reception within a 25-mile radius, and works in buildings, on a golf course, or in an automobile. About the only place where it won't perform is in the subway. Its batteries last about six months. Physicians pay about $12 a month to subscribe to the radio paging service.

Hardly bigger than a glass case, this pretuned plastic receiver weighs only six ounces, easily fits a pocket. Metal disk near end is the earpiece. Other end has rubber-covered antenna.

Powered by hearing-aid batteries, which last about six months, receiver has 30-volt B supply. Button switch is pressed for listening. Bottom of the case lifts off easily for inserting new batteries.



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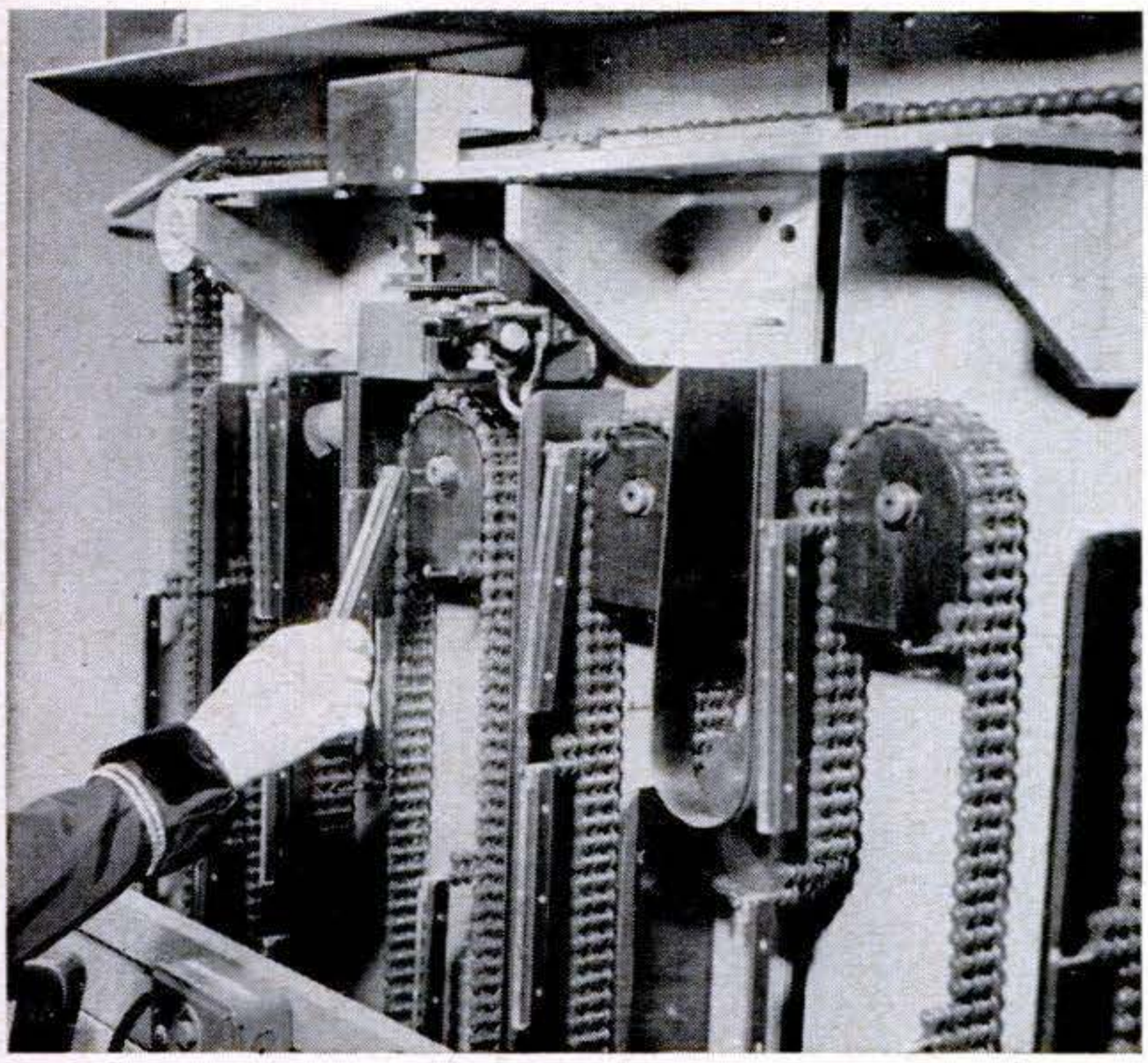
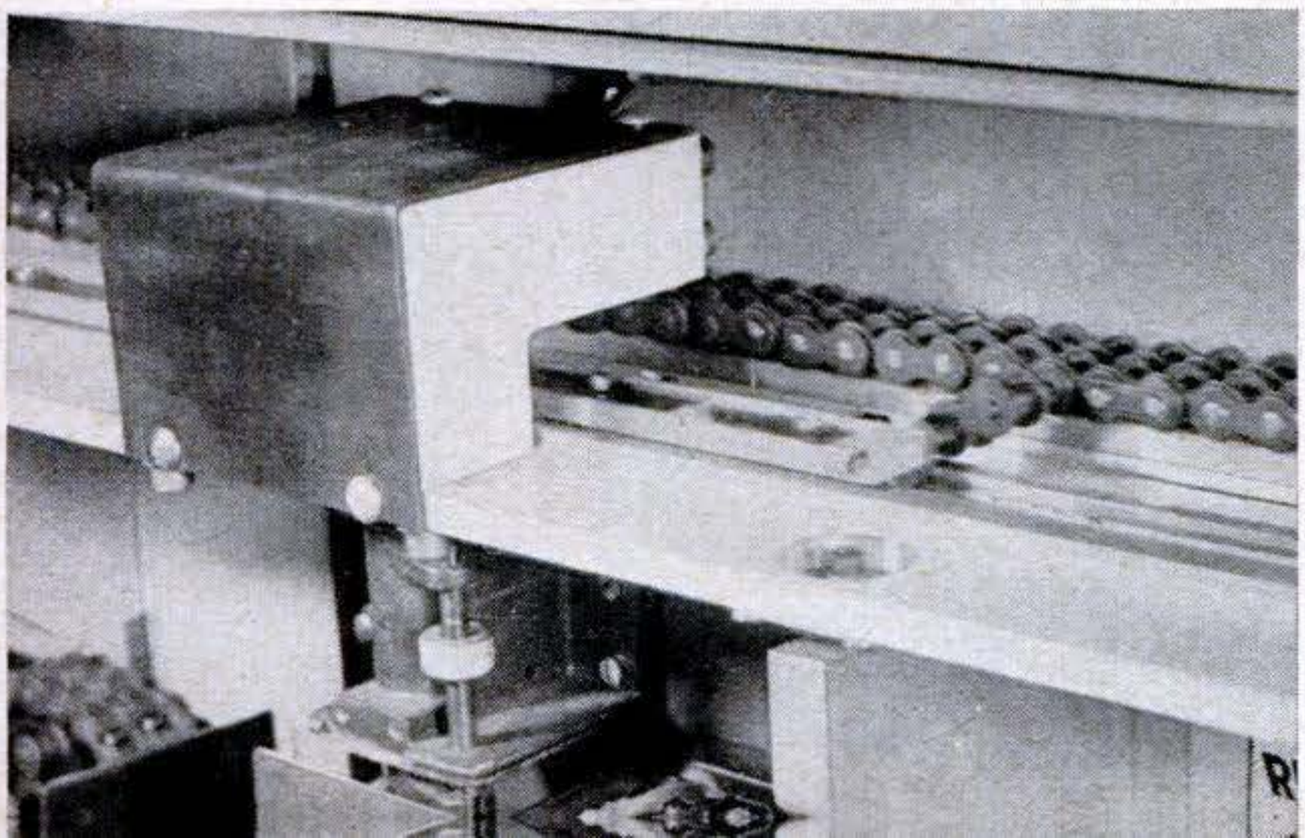
Recorded on 16-mm. motion-picture film, each doctor's code number is encased in a plastic stick. Girl above lifts stick off a filing board to put it on the transmitting machine.



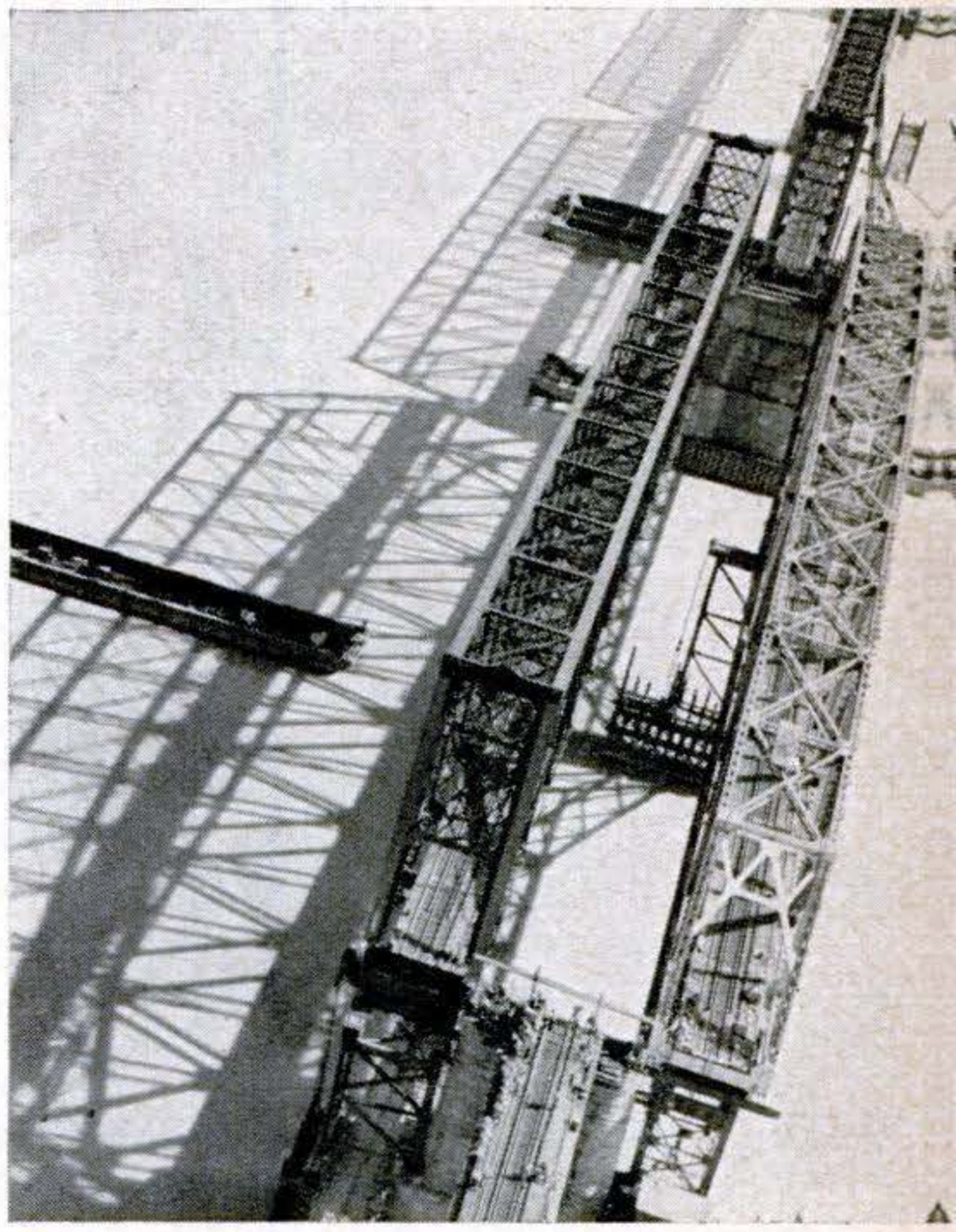
Code stick is hung on an endless chain that moves continuously across the transmitting machine above. Part of the belt can be stopped momentarily to attach the stick.

As stick passes sound head below, similar to that in a sound movie projector, the voice on the film strip is picked up and fed to the transmitter that broadcasts it over the air.



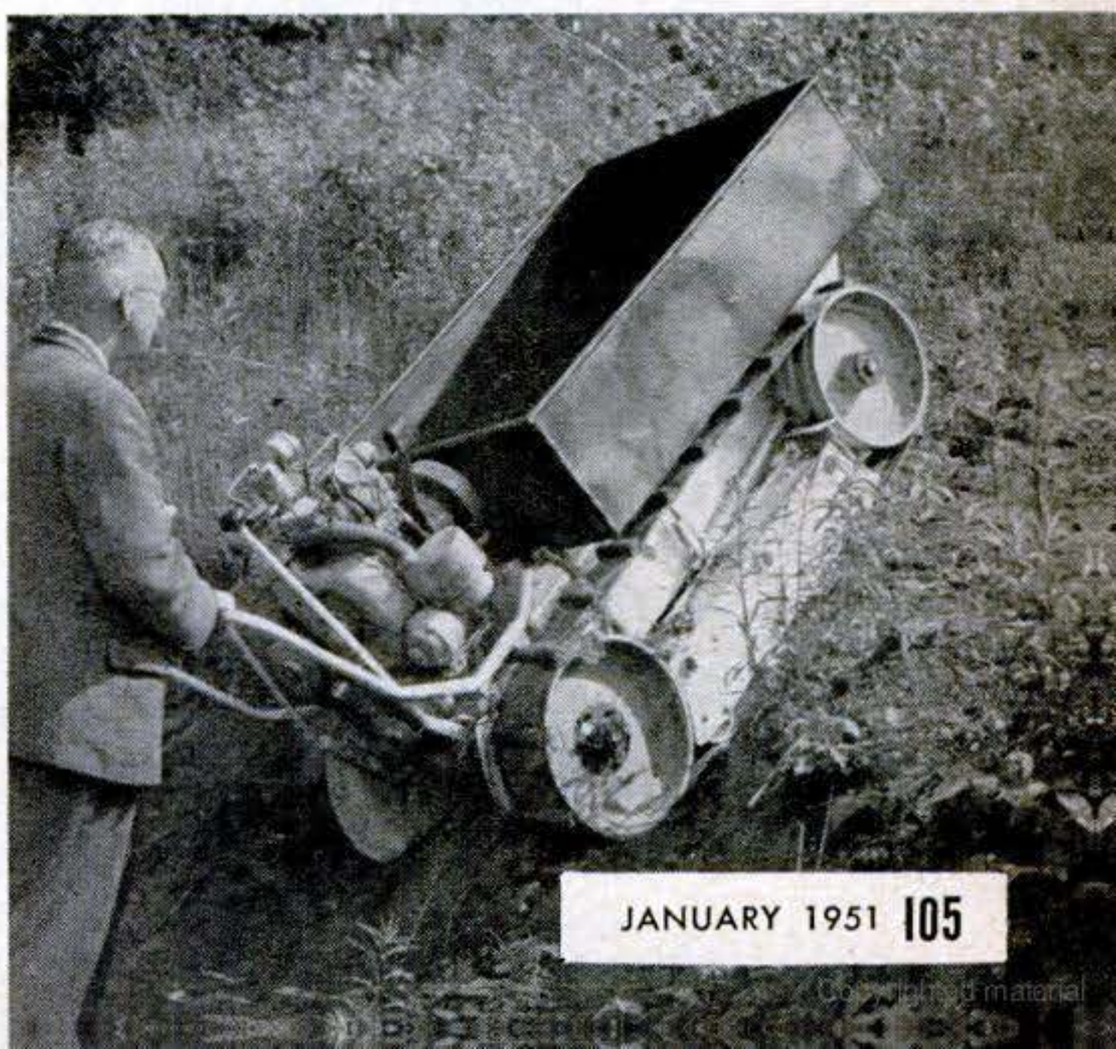
Span Sidles into Place

RACING the clock to cut out-of-service time, workmen rebuilding this bridge over the Ohio River assembled a new 518-foot span alongside the one that was to be replaced. When all was ready, they just rolled out the old span, left below, and rolled in the new one. The bridge is used by the Illinois Central.



"Creep" Totes Fire-Fighting Gear

ROUGH forest trails and brush obstacles don't faze this tracked wagon, developed in Canada for toting 700 pounds of fire-fighting equipment—a stiff load for six men with packs. Powered by a one-cylinder motor, the "Creep" is steered through dual clutches operated by a man walking behind the machine.



Seagoing Sand Dredges Build a Super-Highway

By Walter Hamshar
PHOTOS BY J. WALKER GRIMM

A SUPER-HIGHWAY is being built 118 miles across New Jersey in record time, thanks to the use of ocean bottom for long stretches of the modern eight-lane toll road.

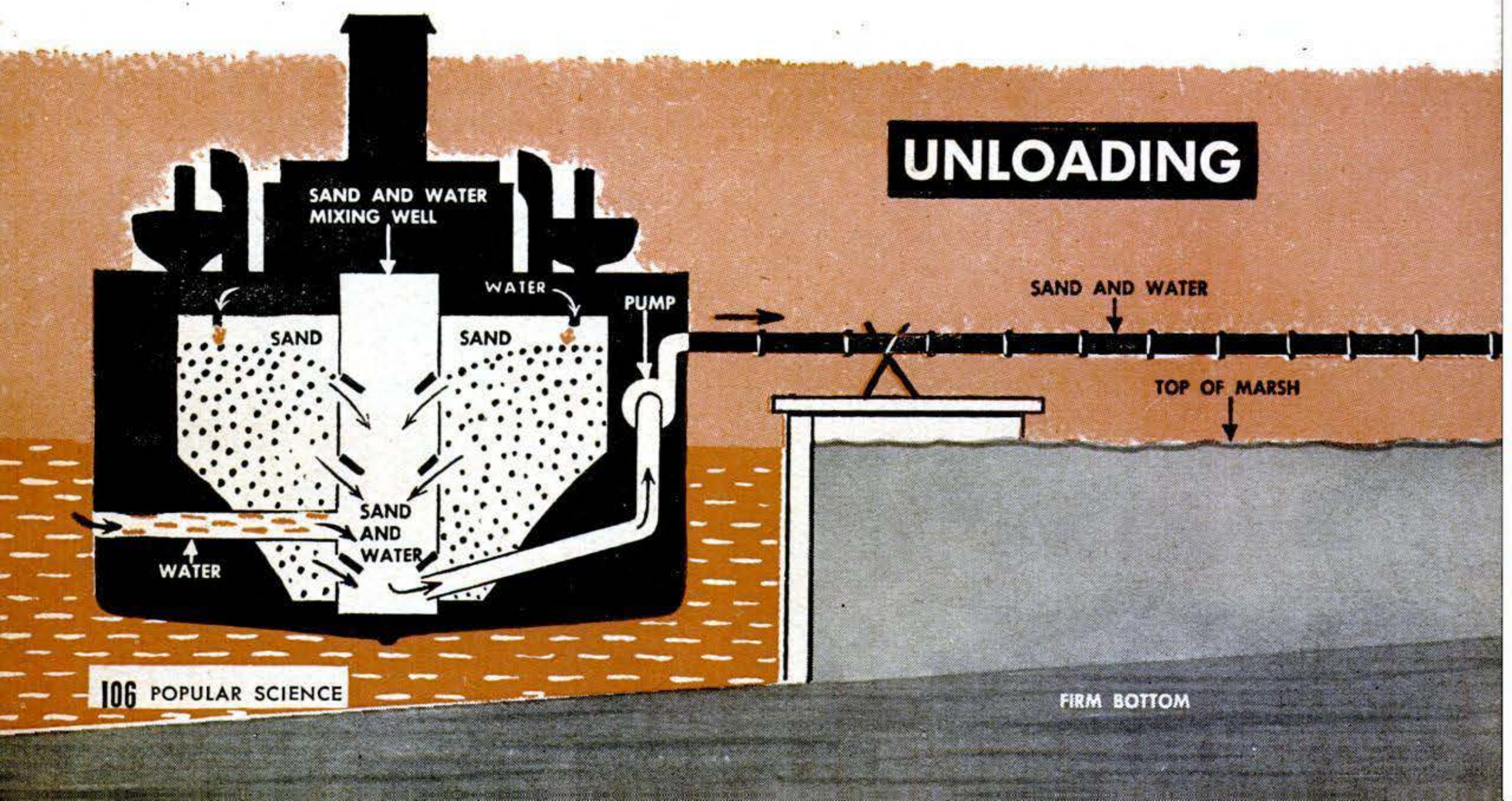
Sand that has been accumulating for centuries on the sea floor off Coney Island and Sandy Hook is being transported 16 miles by a very special kind of ocean-going dredge to fill in right-of-way where the New Jersey Turnpike arrows through mucky swamps. By using this porous material instead of ordinary earth fill, engineers are building a dry roadbed through ooze in a fraction of the time usually needed for fill to settle.

The problem of obtaining astronomical quantities of sand at reasonable cost led Construction Aggregates Corporation, which has contracts for swampy stretches, to design three unique craft from outmoded Army dredges. Instead of performing the ordinary tasks of deepening channels, these ocean-going earth movers now suck up sand from the ocean floor, classify it for coarseness, carry it to a terminal in Newark Bay, and then pump it into 20-inch pipes that carry it up to three-and-a-half miles inland for the road bed.

Rebuilt by Bethlehem Steel Company's shipyard in Hoboken, N. J., at a cost of $3,000,000, the dredges were modified in fifty-one days to meet the rush requirements of the job. As the *Sandchief*, *Sandcaptain* and *Sandmate*, they now work round the clock, seven days a week, carrying as much as 4,500 tons of sand in each load.

Each craft makes an average of two trips a day, sailing 16 miles down Newark Bay and Kill Van Kull through New York's Narrows to the ocean. Then anchoring in 30 feet of water along the famous Ambrose Channel, the vessels perform a double function of deepening an important shipway while obtaining their sand cargoes. In two hours the hoppers are filled, and the converted dredge sets out on its three-hour voyage back to Port Newark.

There the vessel's spout is connected to a 20-inch pipe line, and the sand—mixed



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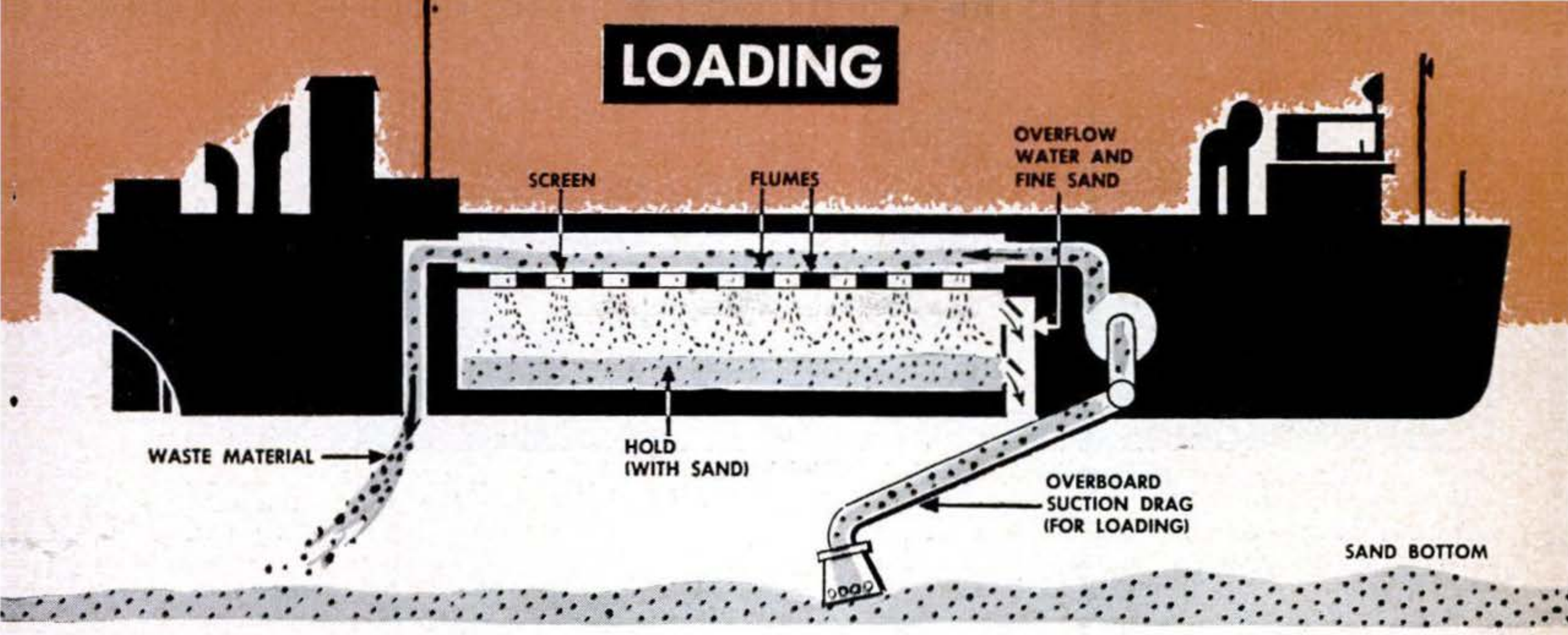
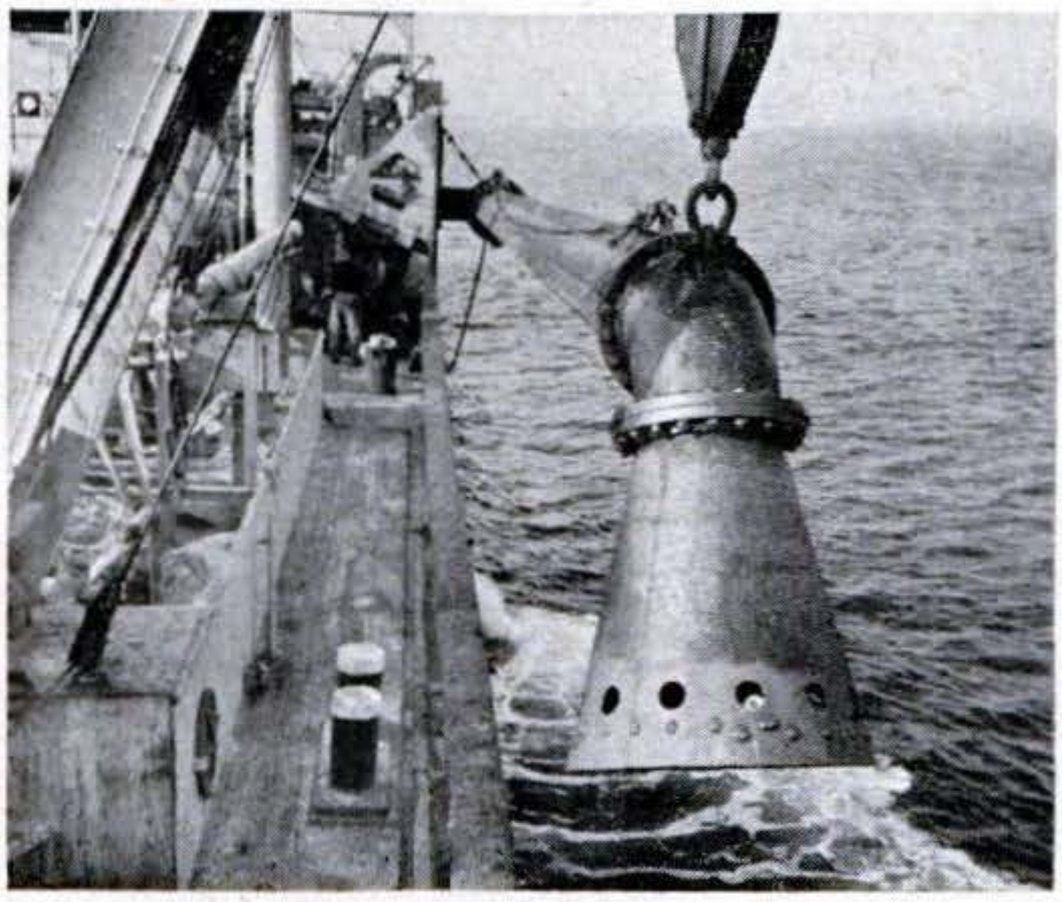
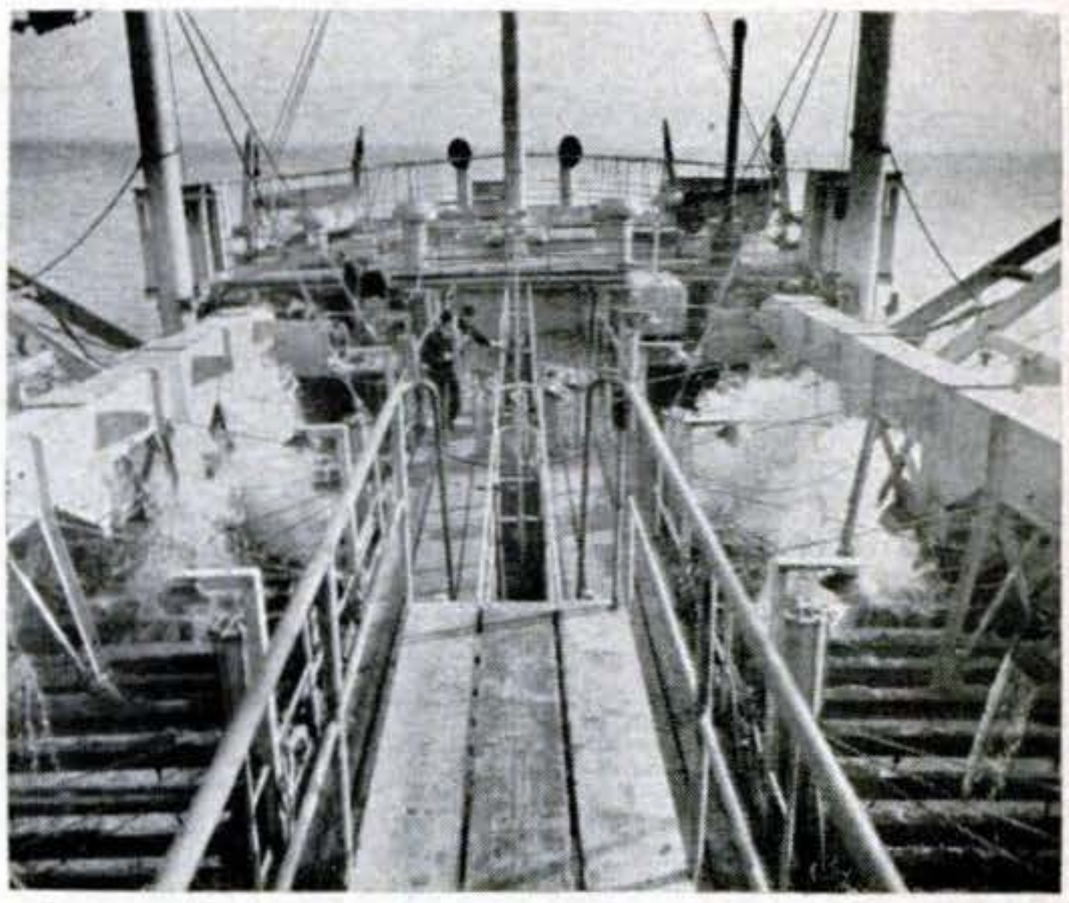
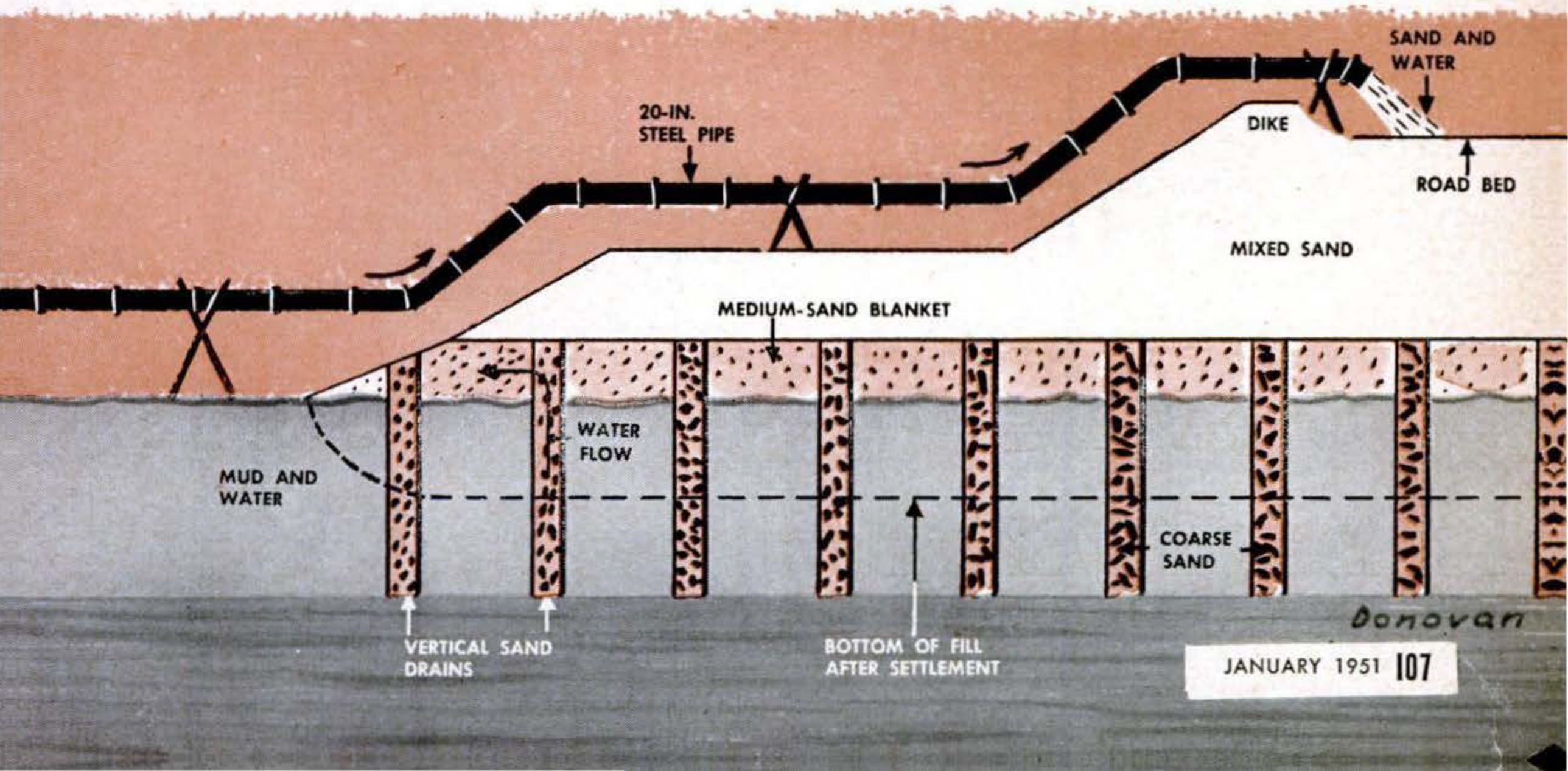




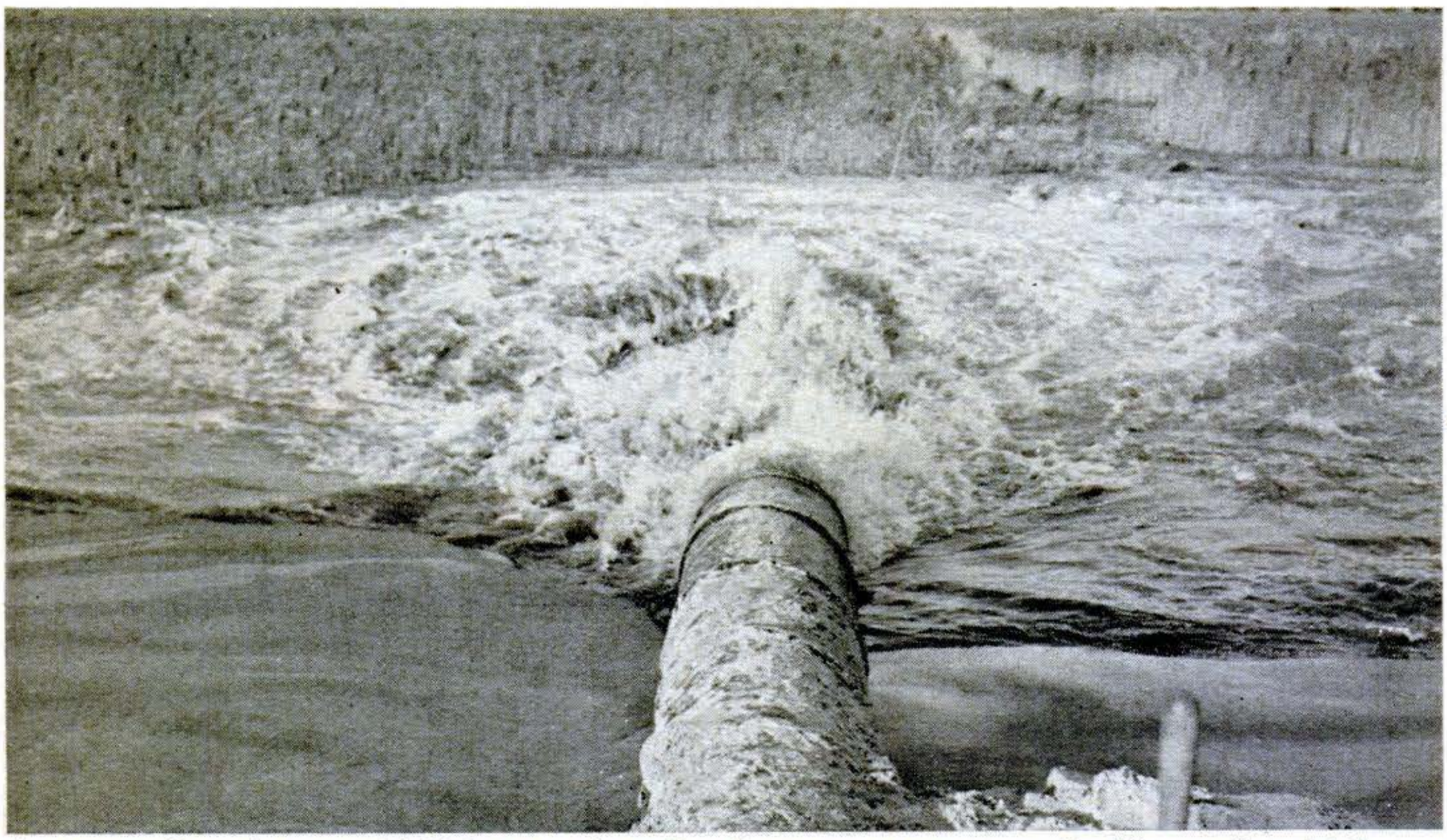
Adjustable drag attached to huge suction pump is dropped from each side of dredge at sea. Ocean-bottom muck pulled up with liberal quantities of water passes through screens that strain out shells, stones, other trash. Crew members watch screen closely: several have amassed valuable collections of old coins that have been sucked up with the sand.



Strained sand and water travel in a flume over ship's big hoppers, the coarsest sand dropping first because of its weight. By regulating flow of mixture through flume, dredge pumps out fine sand—little better for road building than mud already in the swamps—before it can settle into hoppers. As graded sand drops into hoppers, water drains overboard.



At dockside terminal in Port Newark, N. J., the dredge hooks up to a 20-inch steel pipe that stretches inland (right) to the swamp area that is being filled to make a roadbed. A sea cock is opened, and bay water pours into a well in the center of the vessel. This steel, drumlike structure acts as a "carburetor" to mix sand with water again so it can be pumped inland instead of being unloaded into trucks at great cost in time and manpower. As water rises in the well, high-pressure jets around the hoppers force sand through well openings to mix with bay water. Pumps then send it on its way to the swamps, aided by booster pumps along the route to keep the flow rapid enough to prevent sedimentation in the pipe.



At journey's end, some 30,000 tons of sand a day pour over swamp that'll soon be a highway.

with bay water—is pumped overland to the Jersey swamp as shown in the photos above.

To compress the ooze that has lain on the swamp bottom for centuries without waiting the year or two ordinarily required for fill to settle, 20-inch steel pipes are forced through the muck to firm earth. Set 10 feet apart, these are filled with coarse sand and the pipes are then pulled out, leaving vertical columns of sand.

As water is squeezed in the ooze by the weight of fill, it flows sideways until it reaches these porous drains, which allow it to flow rapidly upward to the blanket of medium sand above. There it drains off. As the fill settles, sand dikes are built along the edge of the road bed to permit finer sand to be used in the last stages of the job.

In one 1.2-mile section, 344,000 cubic yards of sand were used for the blanket, 310,464 sand drains were bored, and 852 cubic yards of other dredged fill were employed. Some of the road fill is pumped as high as 60 feet where bridges will be built over creeks and rivers. The general embankment will average 15 feet.

Almost 10 miles of turnpike will be constructed in this manner by next July. Then the three dredges will go to work filling in swamps for an extension of Newark Airport that will be greater than the entire area the field now covers. END

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Shaw Road-Tests '51 Pontiac

I made three passes through this water trough before I got any moisture on the car's floor.

By Wilbur Shaw

PS PHOTOS BY HUBERT LUCKETT

REPORT FROM THE

DRIVER'S SEAT...

TWO things struck me when I sneak-previewed the 1951 Pontiac—a smoothed-out Hydra-Matic and a fine rough-road ride.

Basically, Pontiac looks the same as in '50. It has the lines of a dependable family car that the Missus drives to the grocery. Only the de luxe models have the color and extra chrome associated with "flash" styling. It is still a car for America's Main Streets.

For all Pontiac Division's style conservatism—incidentally something that can save an owner bucks on depreciation—they've made plenty of small mechanical changes. For instance, they've put a bumper pad near the timing chain to keep it from whipping as wear occurs. They've put a new carburetor on the six. The cooling system has been changed for faster warm-up. Compression stays comparatively low at 6.51-to-1. Pontiac isn't a car that won't thrive on regular gas.

I drove the new jobs last fall at the General Motors Proving Ground near Milford, Mich. It's unquestionably one of the most complete road-test places in the world. They have 25 miles of roads, including one "Belgian block" stretch so rough it could wreck anything that took it too fast. They have a fine "Loop" with separate speed lanes. In fact, the 1,225-acre setup is so big, that wildlife is actually a problem. Although the whole place is fenced in, deer

EDITOR'S NOTE: For the fifth successive month the three-time winner of the Indianapolis 500 gives you a tape-recorded advance showing of a new car.

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Smooth as silk at 139 feet per second. This was the six I tried on the high-speed lane of the Loop at GM's proving ground. She was indicating 95, which is pretty good for a 96-hp. low-compression engine with automatic drive. I guess I was a lot more comfortable than the photographers who were standing out in the raw weather to get this shot.

occasionally jump the fence and recently one animal bashed in a glistening sedan.

When I showed up, the Pontiac Motor Division had two tuned-up '51 mounts waiting for me in the garage. One was a six with Hydra-Matic, the other a straight eight with a manual shift. The eight looked slick, but I was more interested in the six, which kicks out 96 hp. at 3,400 engine revolutions. Here's the playback from a recording of my reactions:

The hold-open on this door is the best I've ever seen . . . it's positive in engagement . . . and quiet.

They tell me there are four speeds in the drive range . . . some Hydra-Matics have only three . . .

Firing up still seems to be a two-handed job . . . you turn the switch with your right hand and press the starter button with your left. Why don't more manufacturers follow Ford and put the two together on the left?

This car is nicely proportioned, though it isn't as wide as some of the others . . . at least you can reach the door handle on the opposite side without lying down flat. . . Let's see how this baby picks up. Light throttle now, and we shift into second gear at 6 miles an hour . . . there's third at about 12 miles an hour . . . fourth at about 30. You can delay these shifts with harder throttle.

I was disturbed by something, or a lack of something, that I hadn't quite figured out yet. At this point we rolled onto the Belgian block pavement. It was rough, no doubt about that.

They've done a job on these rear springs. I've driven another car over this same stretch . . . the rear springs kept wallowing until they thudded on the bumper blocks. There was the same load in the rear seat that there is in this Pontiac . . . but there are no hits here . . . we haven't touched a bumper block yet.

I don't like this visor . . . they've put an accessory visor on the front of this car like a bill on a cap . . . it gets in my way . . .

You don't get a sharp downshift as you decelerate . . .

All of a sudden, I had it. I knew what had been bothering me. It was the absence of the klunking, in shifting from one gear to another, that I had always associated with automatic mechanical-shift transmissions. The transition from one gear to another was so smooth that it was hardly discernible. I began to experiment. Try as I might, I couldn't regularly catch the shift into fourth gear.

They've made a ride, all right . . . you won't get a better ride than this . . . it's due to a low spring rate . . . I can't get over how this car keeps its feet on the ground on rough going . . . there's no hopping.

I don't like the position of the brake pedal. It's too close to the accelerator . . . on automatic jobs, they ought to put the pedal over where you can work it with either foot . . . the tires give a normal amount of squawk on tight turns . . . lower tire pressure and you get more squeal . . . that's the penalty you pay for a soft ride.

The seat arrangement is good. I like the steering . . . a pretty good-sized man could

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If you crowded her on a fast turn, there was a bit more roll than I like to feel. But how can you expect to get sports-car cornering from a smooth-riding family sedan?

It was a pleasure to take turns without getting that high-pitched, rubbery squeal. The 7.10 by 15 tires that the Pontiac carries seem to keep these noises down to a minimum.

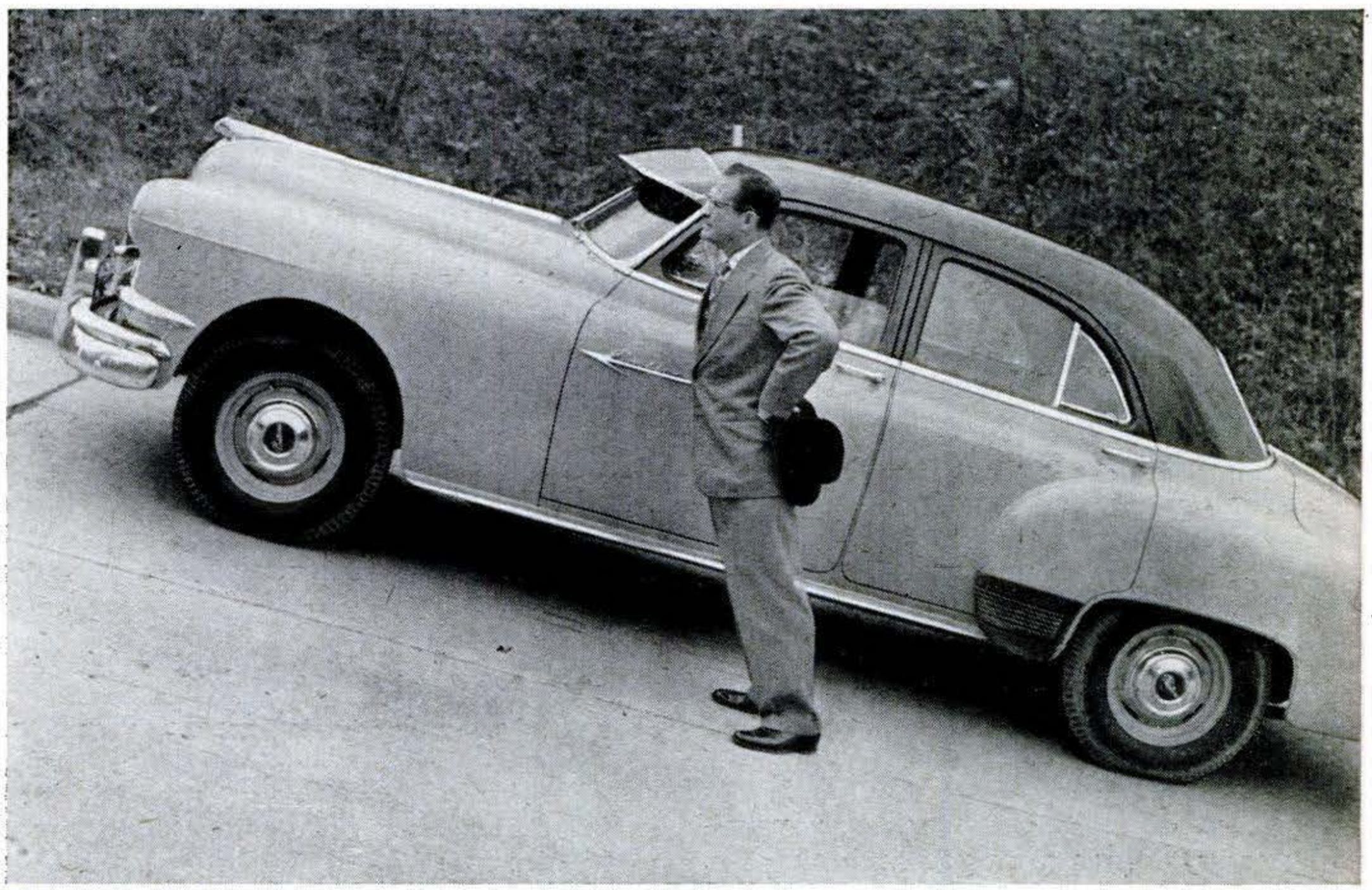
get under this wheel comfortably . . . the backup is smooth . . . there isn't that shudder you get with some of the torque-converter transmissions.

The steepest hill on the proving ground is a 27-percent grade. It's so tough I wanted to try this six on it. On the way I rounded some curves a little fast.

That's a bit too much roll. They could improve on that, considering tread and height, with better stabilizing. . .

There were four people in the car. As I approached the foot of the hill, I had an impulse to get a run to make the top. Instead, I braked to a stop to make it really hard on the engine and transmission.

She starts easily enough . . . but what will she do with this load? We're gaining



This wasn't done with mirrors. It was hard for me to believe it even when I was standing there. It was on this 27-percent grade that I arrived at the conclusion that Hydra-Matic—at least in the version with four forward speeds—can deliver more torque in the medium-throttle positions than can the torque-converter types of automatic transmissions.

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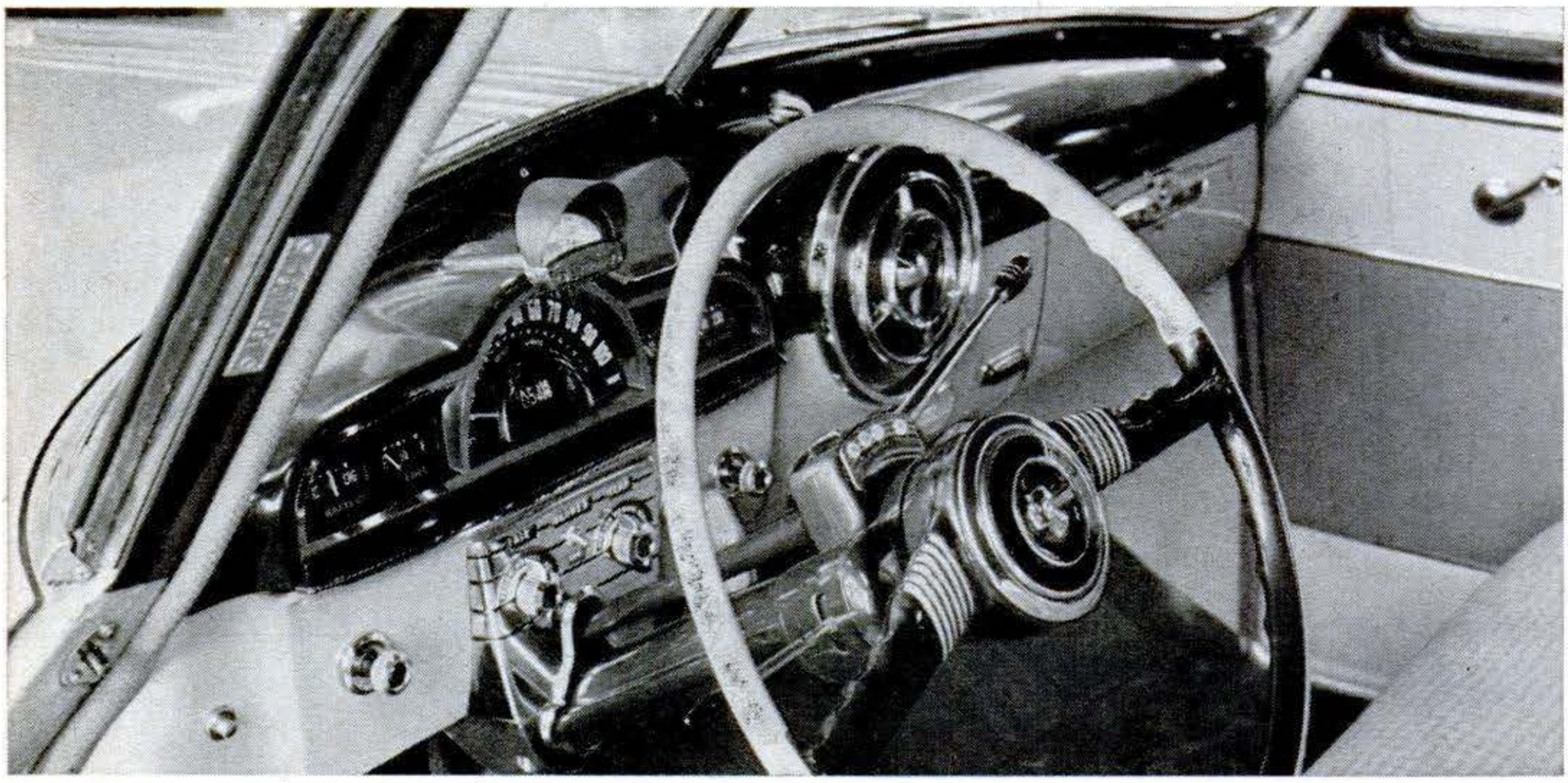
It takes a sharp eye to distinguish the '51 and the '50 Pontiacs. The grille has been simplified a bit. Slowness to make big style changes doesn't hurt at all at trade-in time.

The nameplate in back is to make sure the public identifies it as a Pontiac. These bumper guards are extras. In Hydra-Matic versions the six has a 3.636-to-1 rear-axle ratio.



The dash is mostly unchanged. One thing I did especially like was the heater and ventilator arrangement. On some new cars these controls are about as elaborate as a pipe-organ console.

speed . . . she's in Drive, too . . . gaining.

I called over my shoulder to Hubert Luckett, a POPULAR SCIENCE photographer in the back seat, that I'd bet him a buck the car would shift into second before we got to the top. He covered me.

Still gaining speed . . . it's a shame to take your money, Lucky . . . there's the shift . . . over the top.

Going down the hill, I was agreeably surprised to find that the Hydra-Matic gave me more engine braking power than a torque converter. Then we went onto the Loop to roll the six with the throttle floored. The speedometer needle stood at 95 m.p.h. as I eased off. Even allowing for instrument error, that's pretty good with 96 hp.

Next I took a brief turn in the eight. It felt like its 20 additional horsepower. What interested me more was its appointments. There were no bright surfaces to reflect sunlight in your eyes. The heating-ventilating system was so well-labeled you didn't have to be checked out to run it. The body was roomy but Pontiac hasn't wasted sheet metal in enclosing dead air that you carry around just for looks.

As I braked the eight to a stop, a mechanic in coveralls strolled over. "What do you think?" he asked.

"Wrap it up," I replied, "and I'll take it along with me." END

This Month's Shaw-ism

The total cost of inviting the other fellow to dim his lights is a slight pressure of toe on button.

Kilton Shaw

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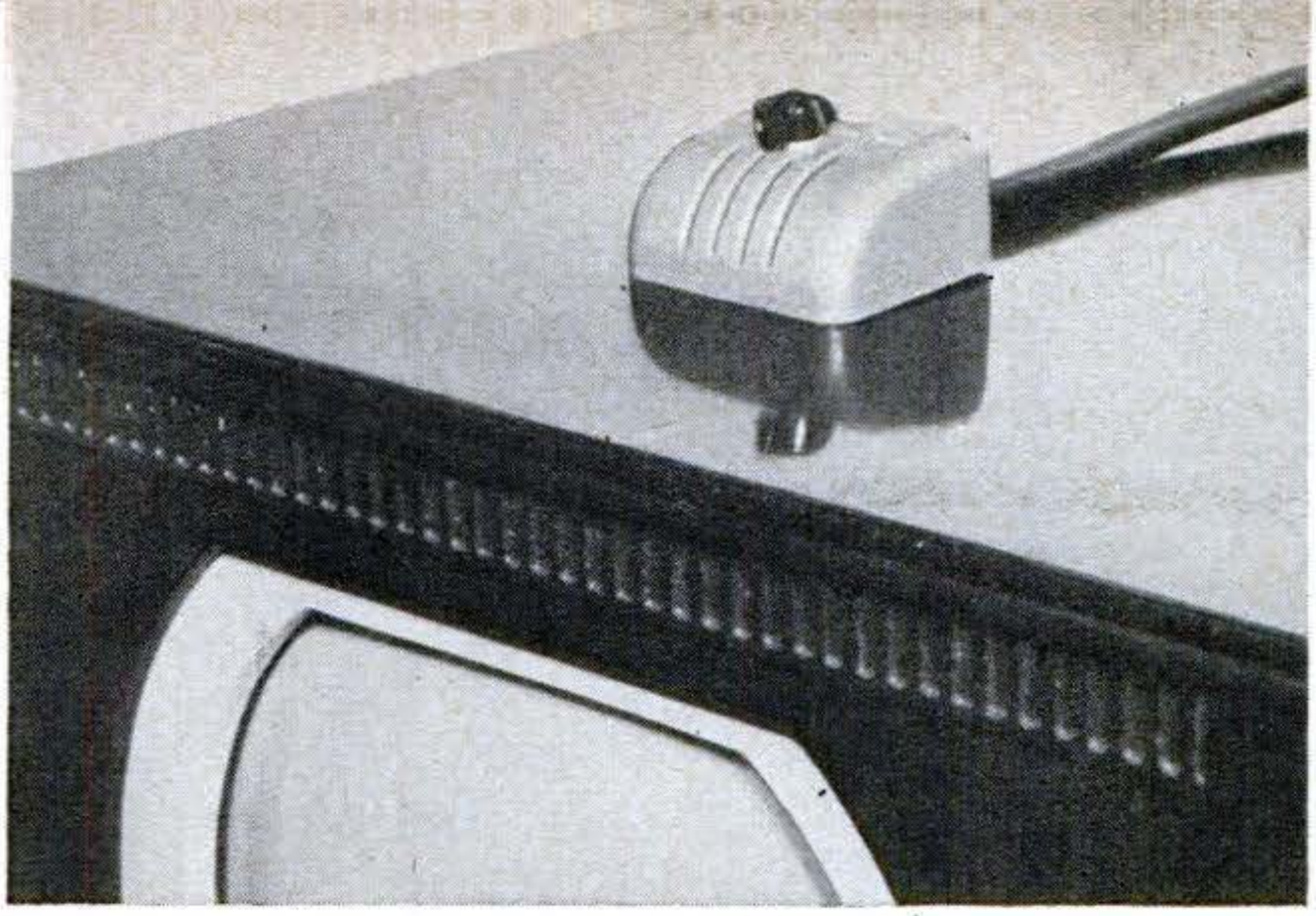
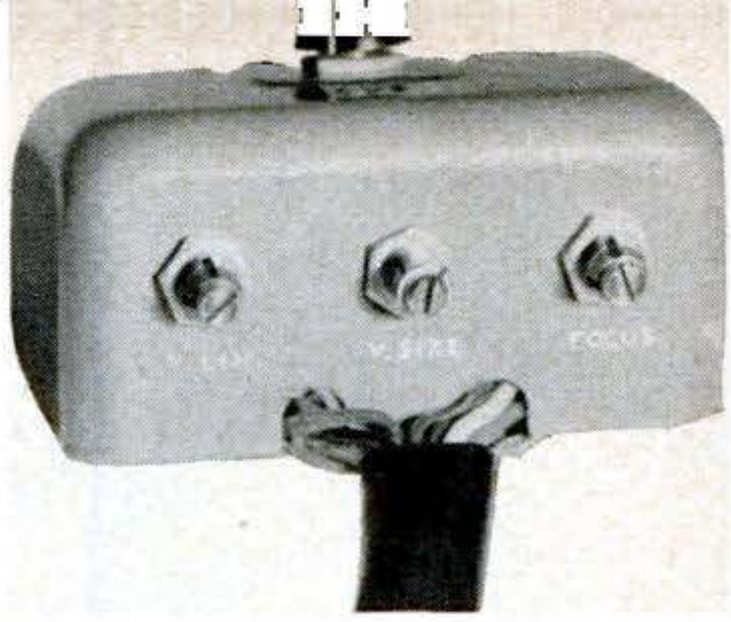




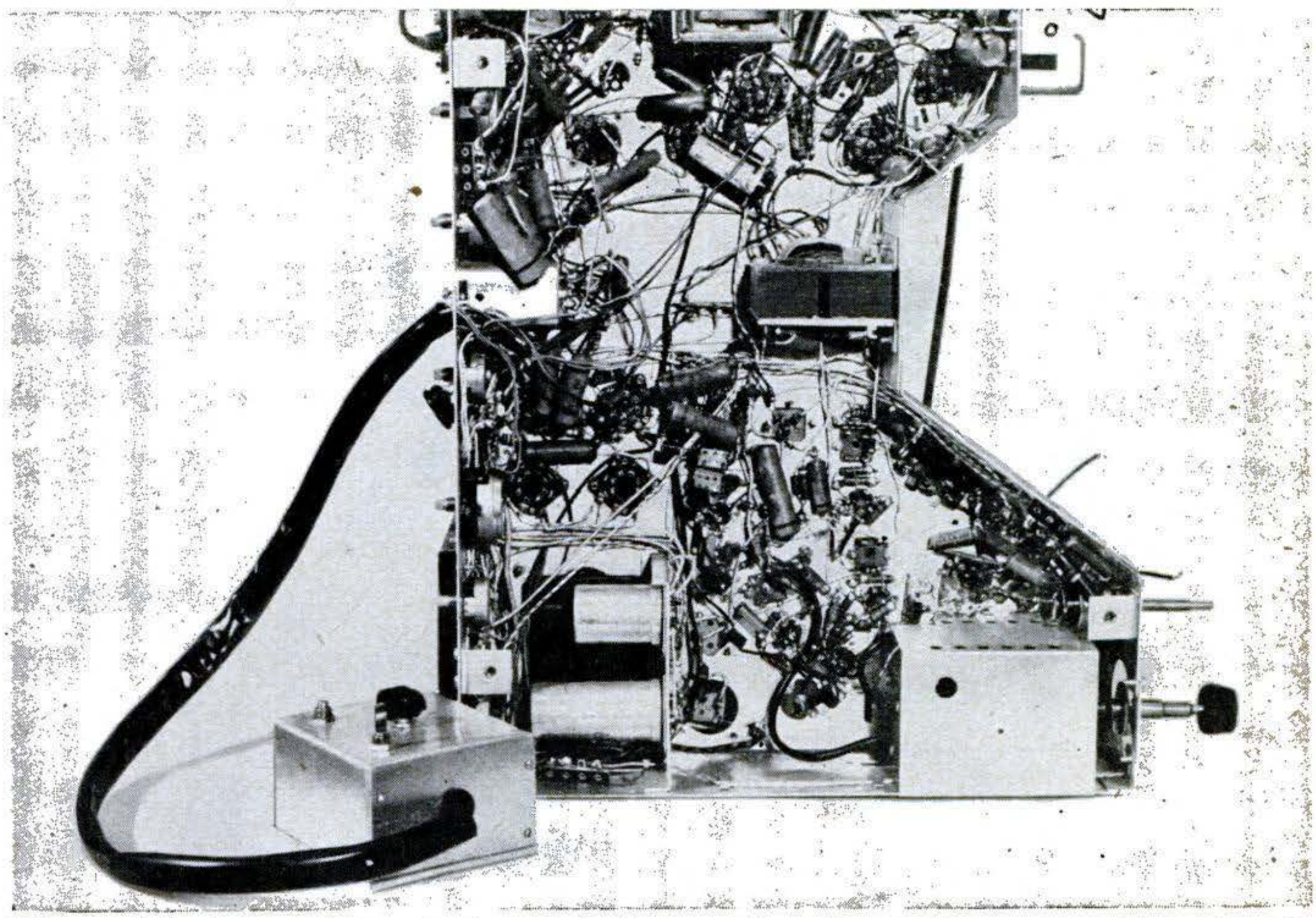
Color adapter, designed for use with a popular TV circuit, speeds up the electron beam so that it can trace out color pictures in black-and-white. Switch is on top. Fixed controls on back adjust focus and size.

$13 Adapter Catches TV Colorcasts

YOU may be able to make your television receiver "compatible" with CBS color for as little as $13. An adapter unit that you can install yourself has been put on the market by Television Equipment Corp., New York. It will alter any teleset of the RCA-630 type so that it can receive—but only in black and white—either color or black-and-white broadcasts. Receivers using the basic 630 circuit were introduced by RCA and duplicated by other makers.

The adapter makes switch-controlled changes in the circuits of the set. To install it you have to be able to identify several circuits, remove a couple of small parts, and solder in 15 leads from the compact, streamlined adapter box. Once it's installed and adjusted, you operate it by turning the switch from "color" to "black-and-white."

Even though adapters don't get pictures in color—for that a "converter," or synchronized, rotating color wheel is needed in addition—they do make good monochrome pictures out of color broadcasts. END



Pilot model of new adapter is shown wired to receiver. Instructions come with each unit.

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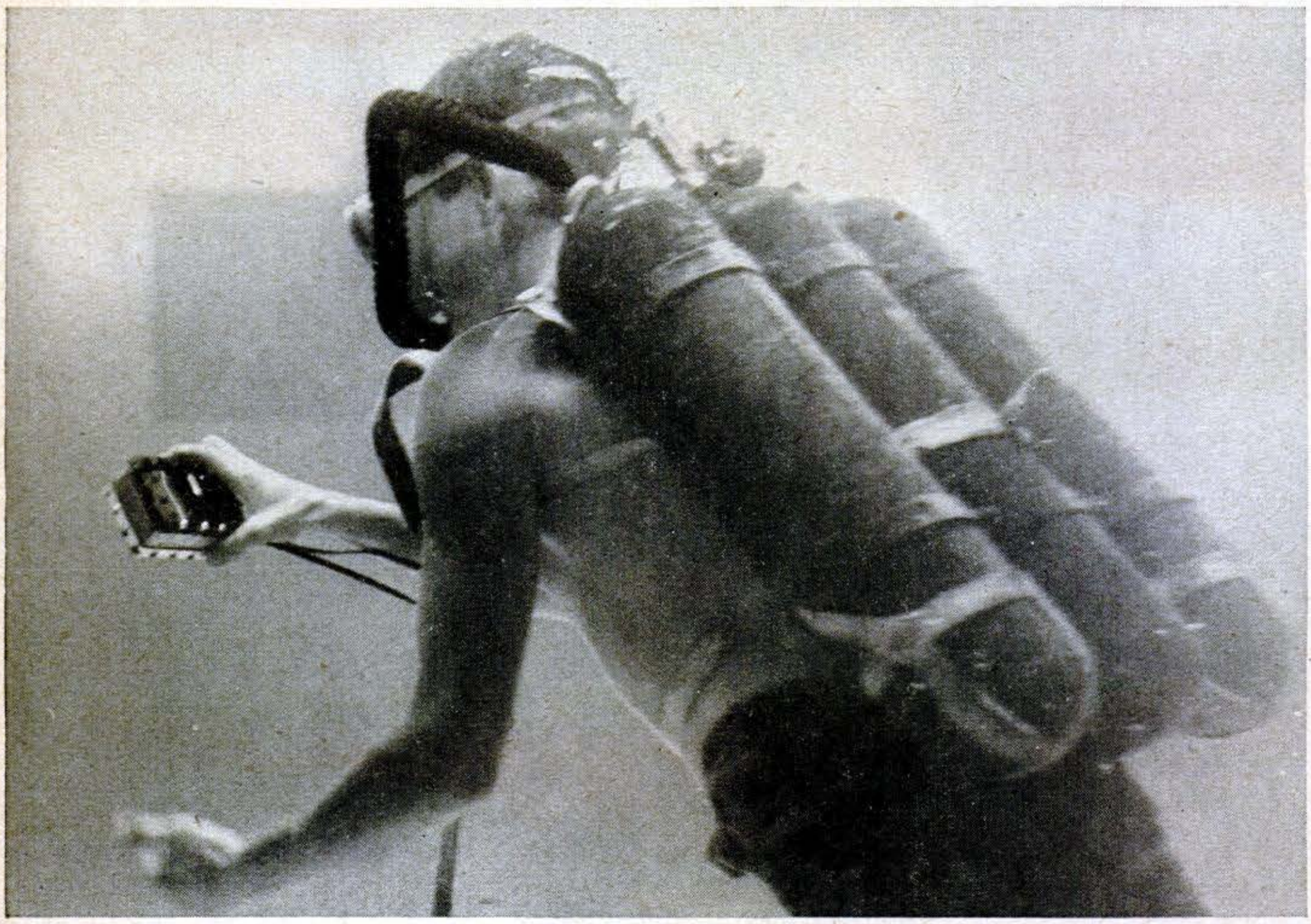
Sample from movie taken with new underwater camera shows diver 85 feet beneath surface.

Undersea Camera Has Own



Underwater cameraman uses an exposure meter made waterproof with a metal-plastic case. Photo shows how Aqualung compressed-air breathing apparatus leaves diver's hands free.

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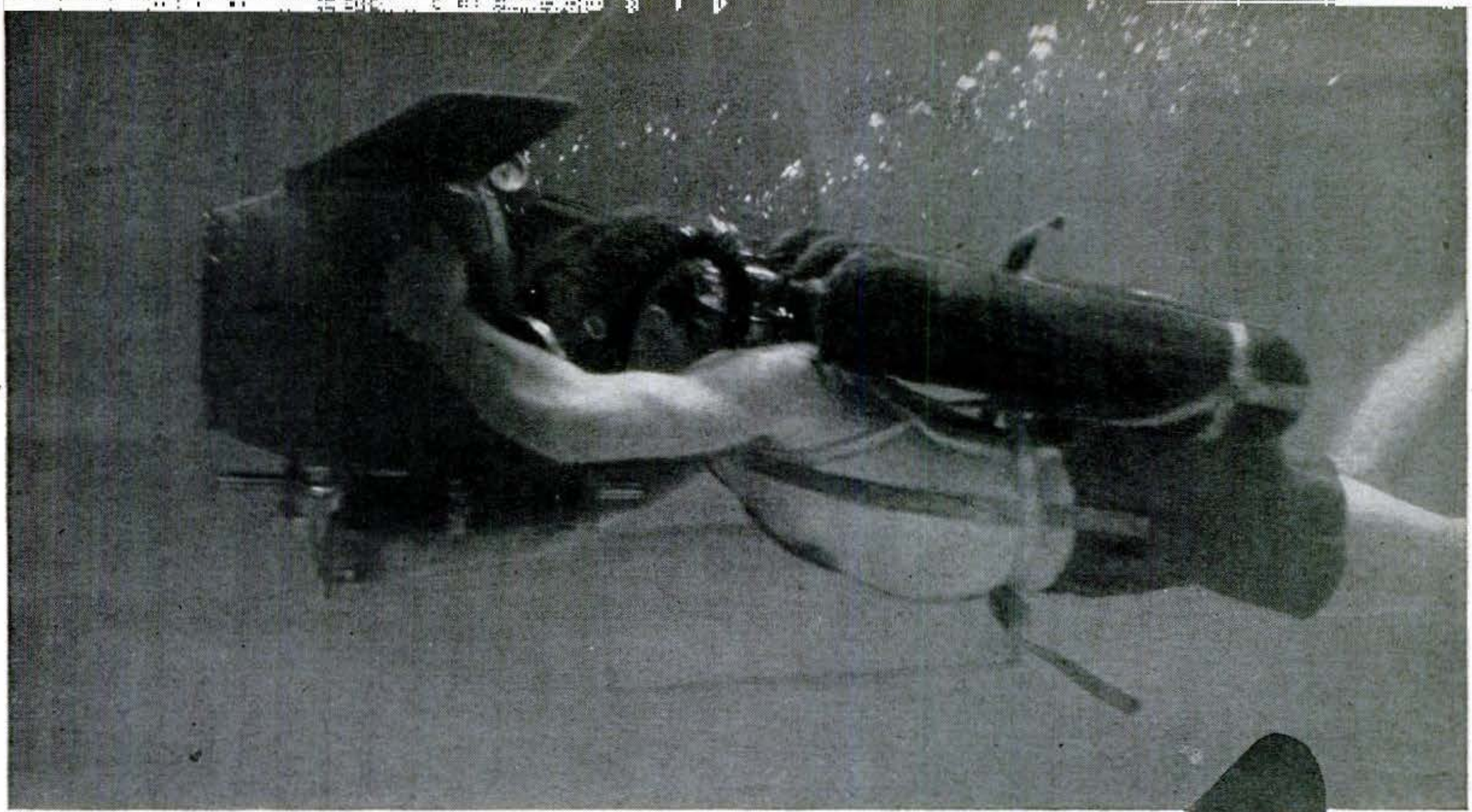

Diver-photoman uses fins to stabilize camera.

Air, Power

A MOVIE camera that swims like a fish is the U.S. Navy's latest wrinkle. The camera is a 35-mm., French-made Aquaflex, enclosed in a blimp-like metal case equipped with exterior controls for the lens diaphragm, focus, and start-stop switch. No lines to the surface are needed. A battery-powered electric motor drives the film.

The blimp has both vertical and horizontal fins. The horizontal fin acts as a planing surface, so that the diver can sight through the view finder, kick his flippered feet, and guide himself through the water by tilting and banking the camera. The device has its own cylinder of compressed air with a demand valve that maintains internal pressure always three pounds above the sea pressure, keeping out water. The outfit weighs 107 pounds but can be adjusted to have positive, negative, or neutral buoyancy. While operating the camera under water, the diver is equipped with an Aqualung, a French-made, self-contained, compressed-air diving unit. He also wears water goggles and swimming flippers. Both camera and diver could operate at depths up to 200 feet. The rig will be used to make training films for the Navy. END

Diver equipped for underwater photography, with new camera, compressed air supply, goggles, and swimming fins. It is the first self-contained undersea photo rig.

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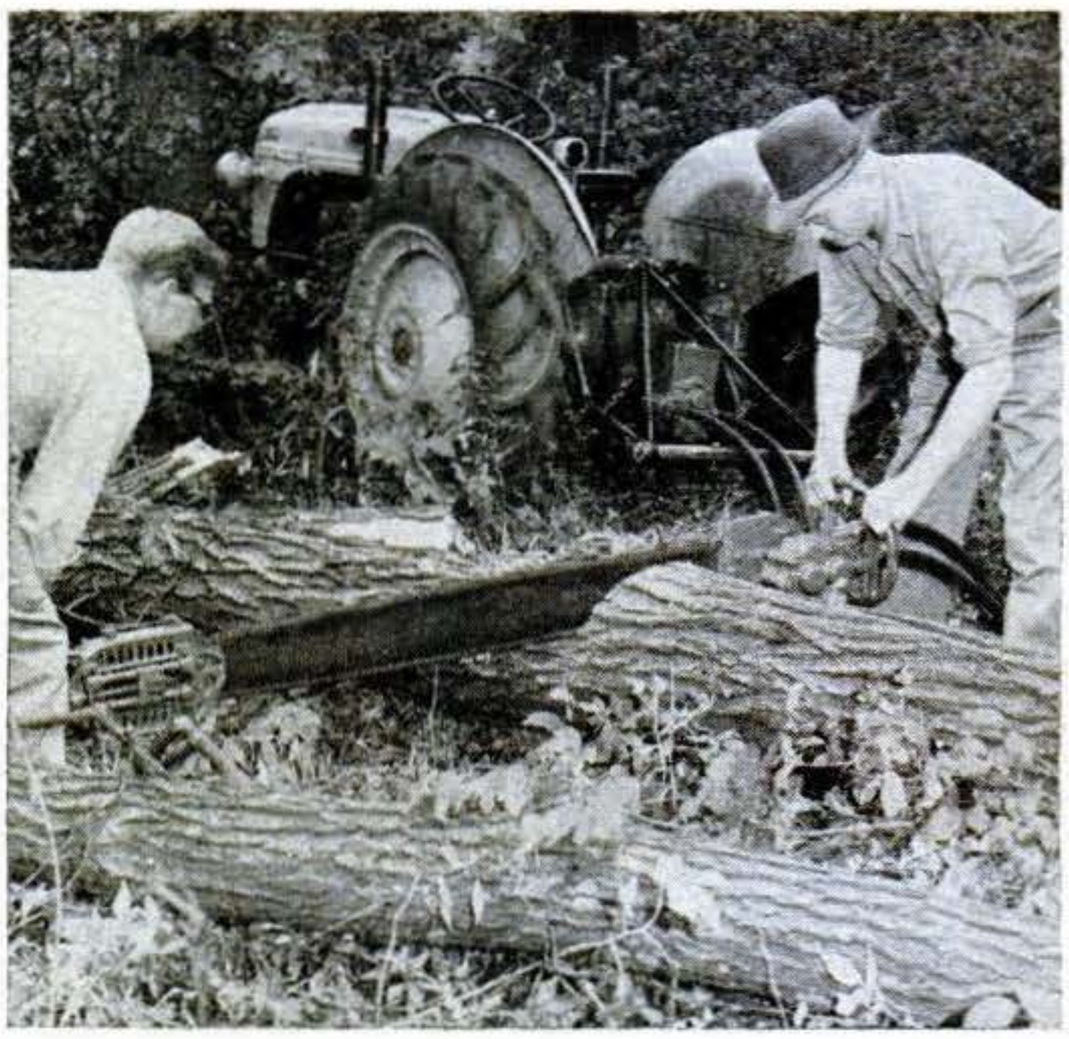
Life Raft Resembles Circus Tent

ONE man (left above) can lug a new Air Force life raft and all survival accessories to accommodate 20 men of a plane downed at sea. When thrown out of a ditched aircraft, the pull of a lanyard attached to a compressed-air tank inflates two rubberized nylon inflation tubes, resembling huge truck tires. A floor section is between the tubes, so it doesn't matter which side is launched up. The protective canopy, shown erected at right, is dyed a high-visibility red, has a radar reflector, and a drain to catch rain water for drinking.

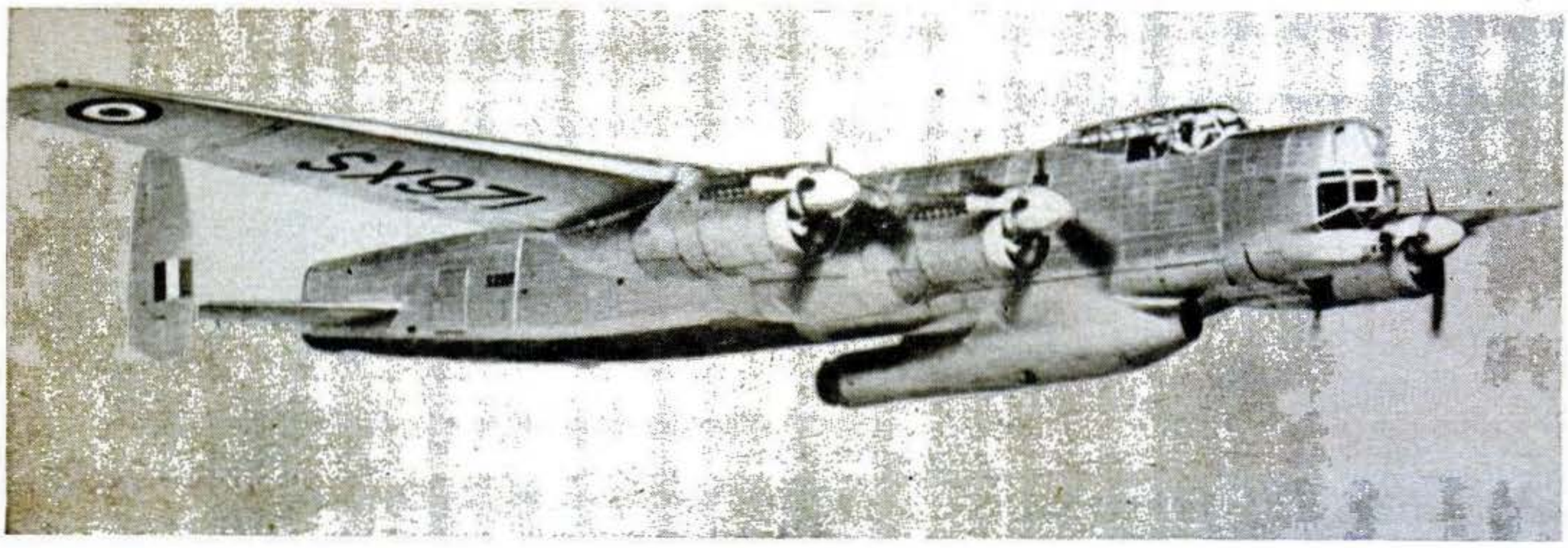
Chain Saw Is Hydraulically Powered

THE chain saw at right is spun by a hydraulic motor, which gets its power from a pump on the tractor. Engineers at the Von Ruden Manufacturing Co., of Claremont, Minn., who perfected it, say the system is light in weight and easily controlled. Long hoses permit operators to fell trees or cut logs from virtually any position. The pump unit is hooked to the power take-off of a tractor or stationary engine. A small control lever allows starting and stopping saw without throttling the power source.



Prop Plane Aids Jet Research

THE Derwent jet engine fitted to the bomb bay of the British Lincoln bomber below leaves the main job of propulsion to the plane's four propellers. Its function is to record for automatic observers the characteristics of after-burning, the combustion in a jet's tailpipe that is used to increase engine thrust. To protect the plane's underside from the jet's hot exhaust gases, the bottom of the fuselage is covered with stainless steel.



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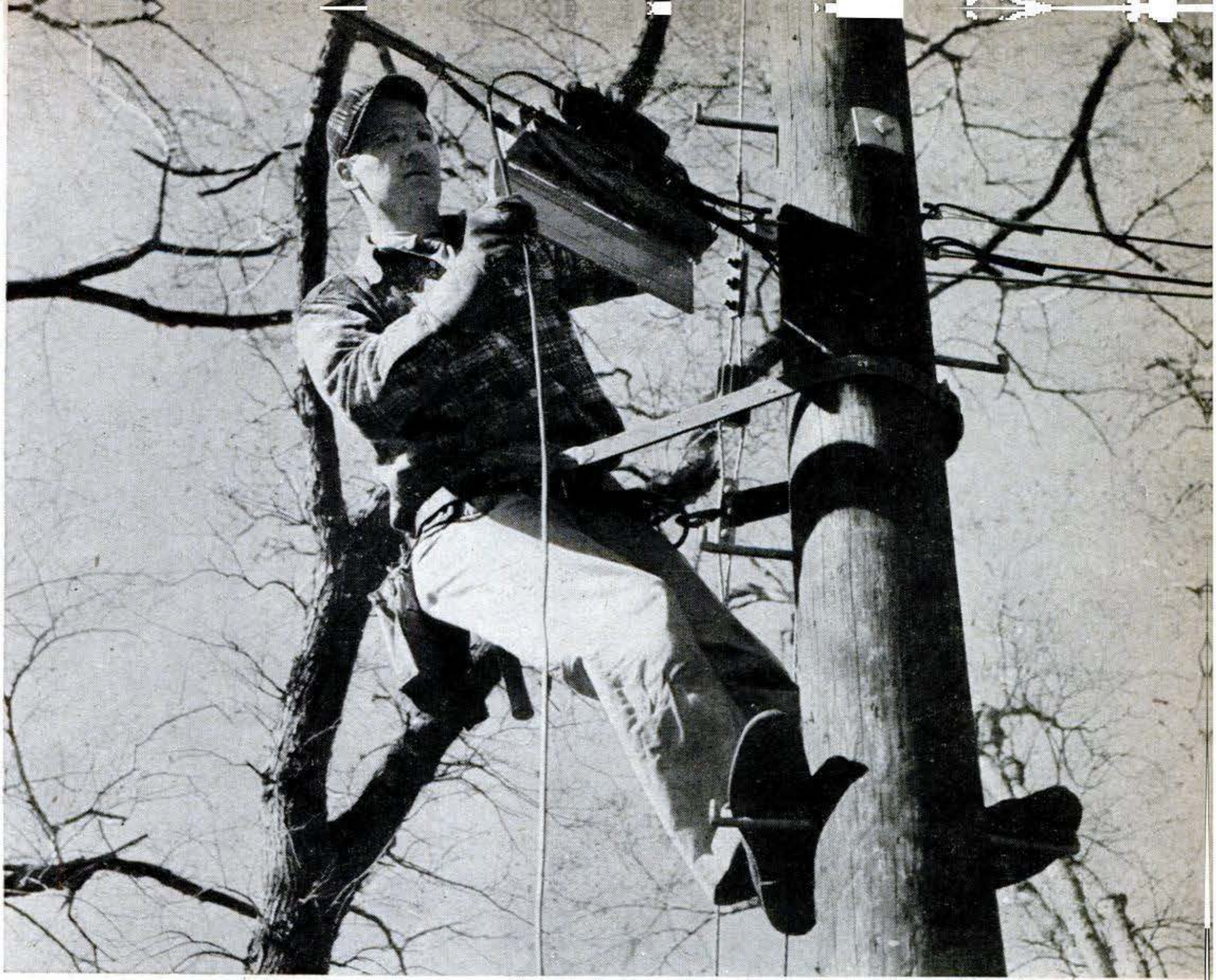

Signal that a new phone is on the way—Charlie Thomas, installer for the N. Y. Telephone Co., connects wire that goes to the house to one (called a "pair") that goes to the exchange.

How Your Telephone Man Works

PS PHOTOS BY W. W. MORRIS

CHARLIE THOMAS climbs a pole like the one in the picture above a dozen times a day—just trying to catch up with the American demand for more and more telephones. Of the 8,000 new ones that join the Bell System every day, Charlie and his partner usually install four.

Pole-climbing is only part of the job. Charlie must also be a carpenter, an electrician, and something of an interior decorator. Neat, inconspicuous installations are what the customers expect. So Charlie and his partner, Joe Fennell, a telephone man for more than 25 years, must line up outside wires carefully, conceal inside wires in walls, floors, air ducts, or closets.

New houses, like the one Charlie is working on in this installation, pose special problems. Slab floors and insulation-packed walls offer no hiding place for wires, composition siding doesn't hold screws well and cracks if treated improperly, and even the attic—intended for future rooms—cannot be cluttered with wires or boxes. To see what it takes in equipment and skill for a neat installation despite these obstacles, turn the page.—*Martin Mann.*

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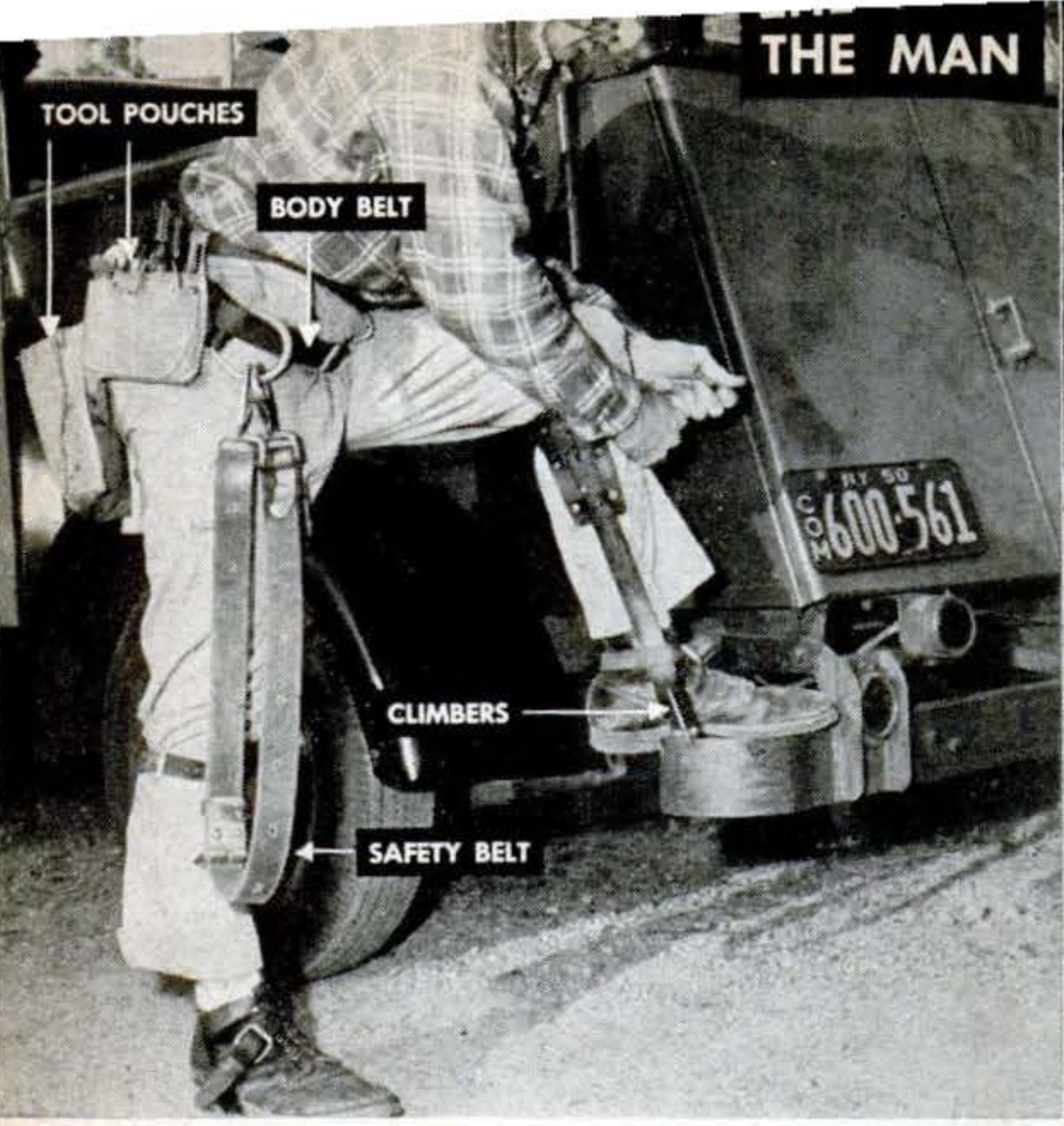
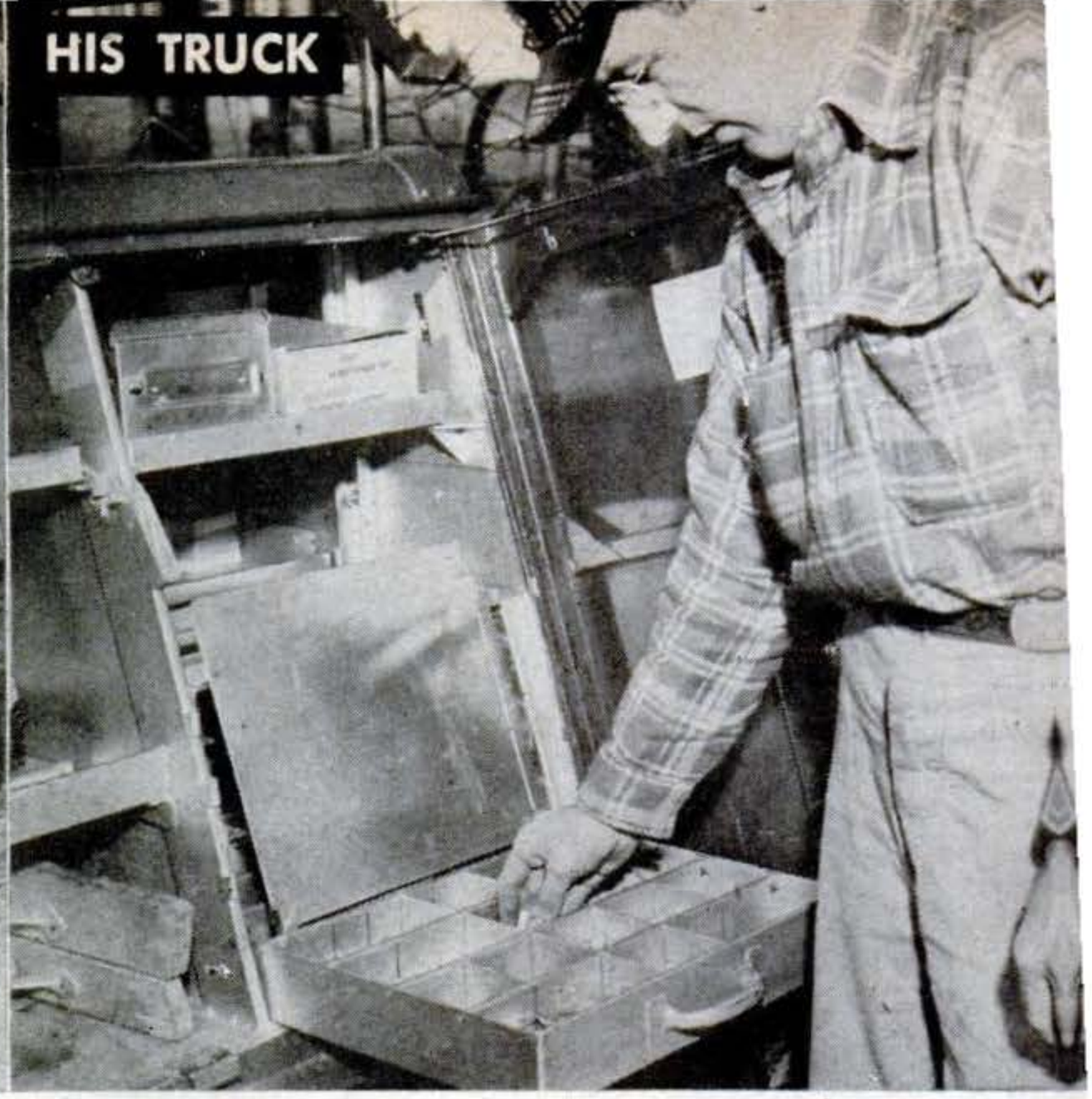
THE MAN



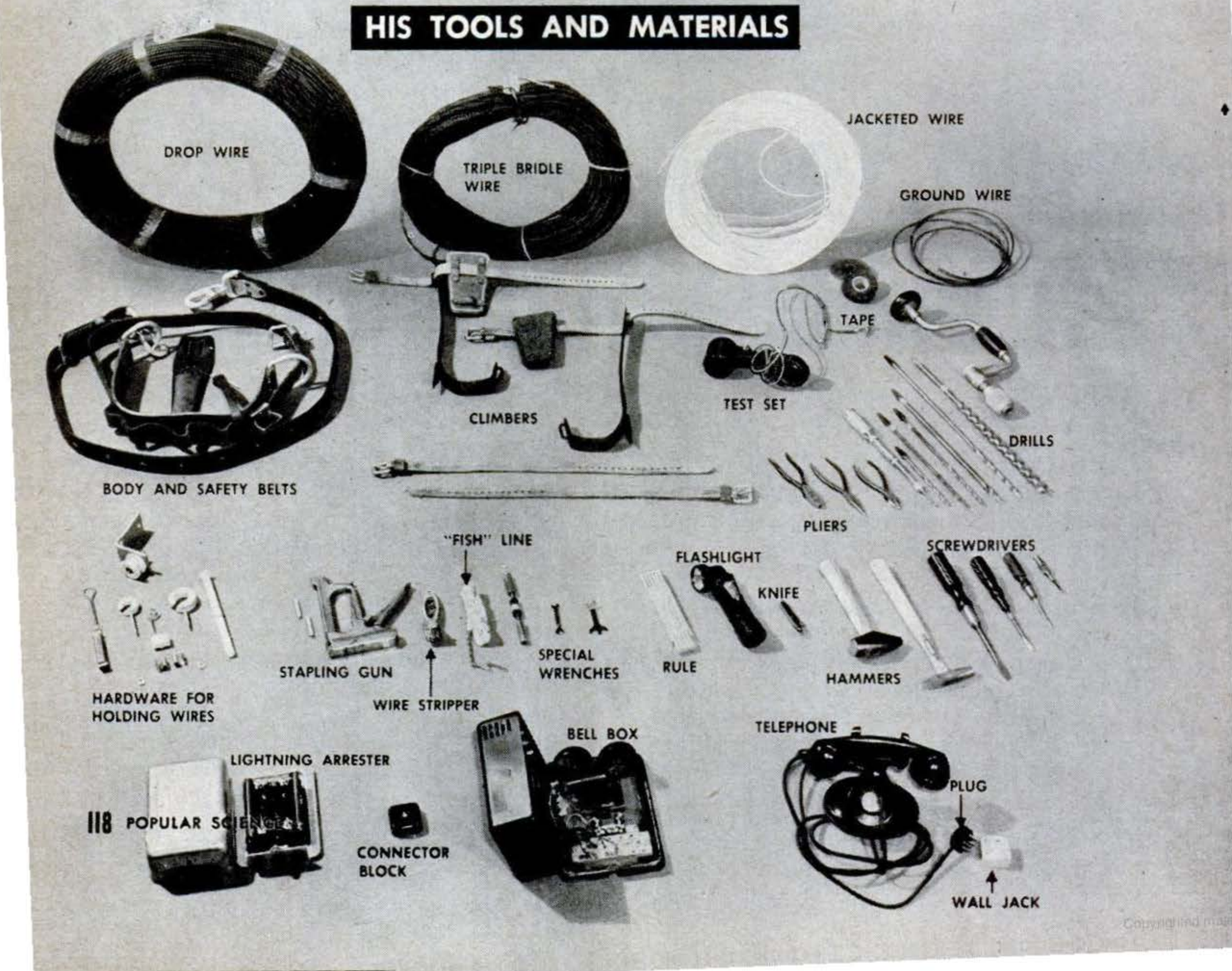
What the well dressed telephone man wears. Charlie straps on his climbers before starting his pole work. The safety belt hangs from loops on his body belt, which also supports tools and pouches for hardware and supplies. Notice ankle-high shoes, a necessity for pole-climbing.

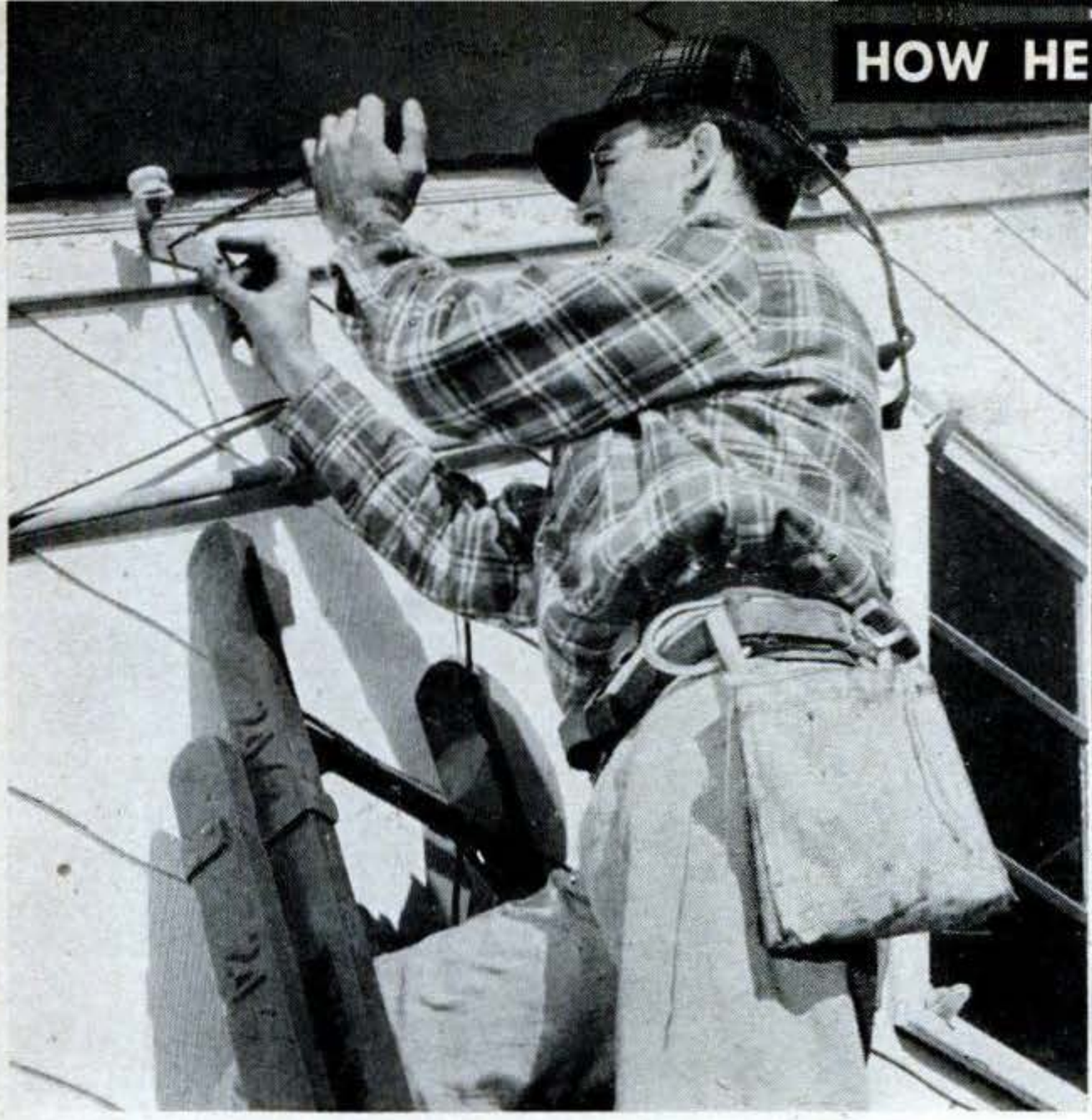
HIS TRUCK



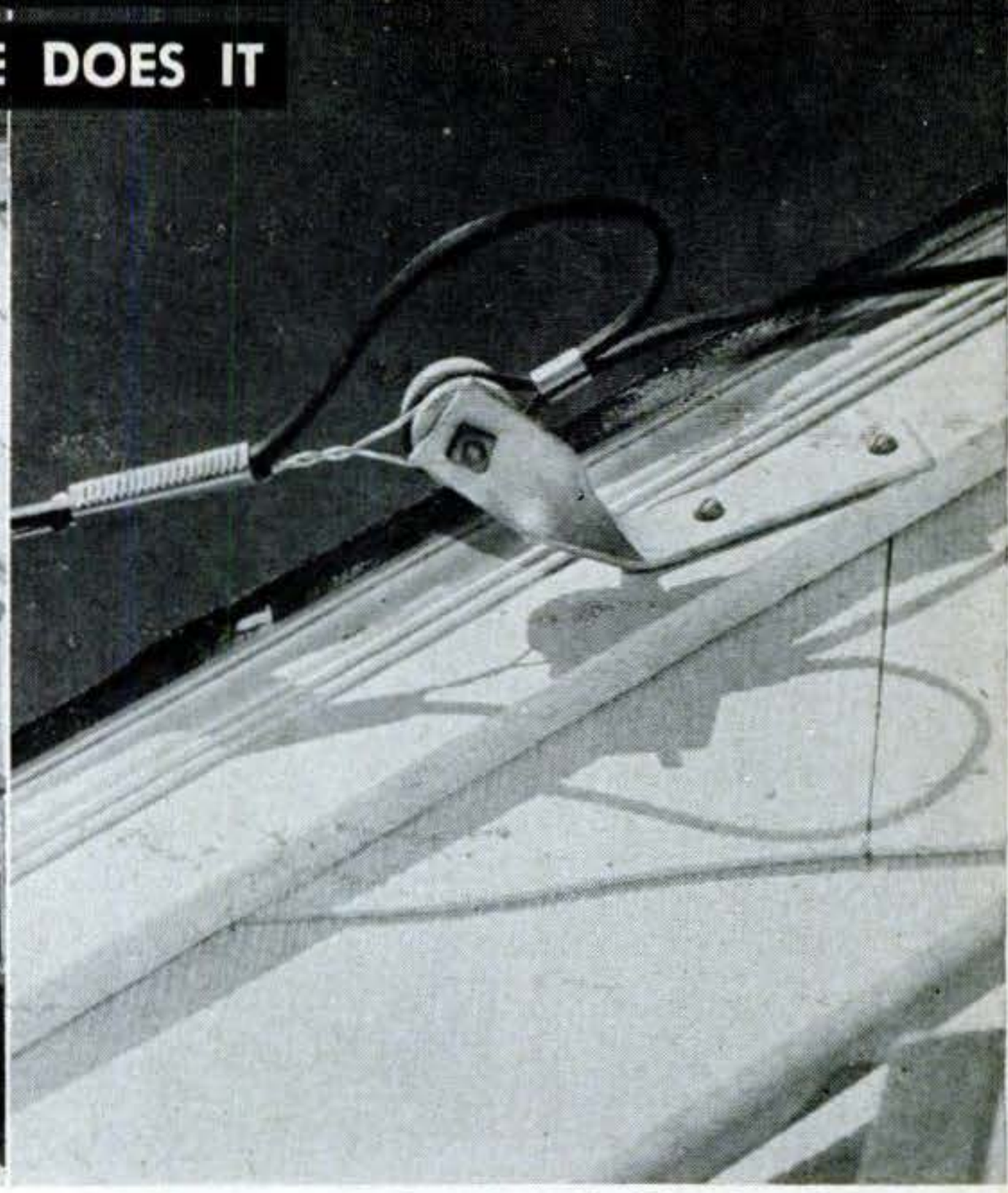
Familiar dark-green truck has racks for ladders and a body designed with compartmented drawers and shelves for all kinds of supplies. Truck normally carries equipment and materials for many types of jobs. Photo below shows only things needed for this particular installation.

HIS TOOLS AND MATERIALS





1 The job of installing a telephone starts at the house, no connection being made to the pole wires until the lightning arrester is in place. Above, Charlie Thomas attaches the corner house bracket that will hold the "drop" wire running from the house to the nearest pole.



2 The corner bracket holds the drop wire through a specially designed copper clamp, so that there is no strain on the wire loop around the bracket. The big loop allows for expansion and contraction as temperature changes. New neoprene-coated wire lasts longer, resists icing.

3 To locate stud, Charlie measures from edge of window. He'll screw in two insulated eyes so that wire makes gradual turn to run down side of house. Installers avoid sharp turns, which may wear on wire. Eyes must be screwed into stud, for this siding won't hold them.

4 Lightning arrester is grounded to outside water faucet. Arrester consists of two closely spaced carbon blocks that short excessive voltages to ground. Ground connection is also needed so that this telephone can be rung without disturbing others on party line. *[Turn the page.]*

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6 While Charlie reaches under attic floor boards to locate the right spot, partner Joe Fennell works the drill. He expected to make hole in studding space between rooms—and did. Wire is fished along eaves between floor joists, then down between wall studs to baseboard.

5 With lightning protection in, actual connection to outside cable can be made. In this case—the first party on a new four-party line—wire has to be strung quarter of a mile down road to nearest terminal (shown on p. 117). When this is done, work inside house can begin.

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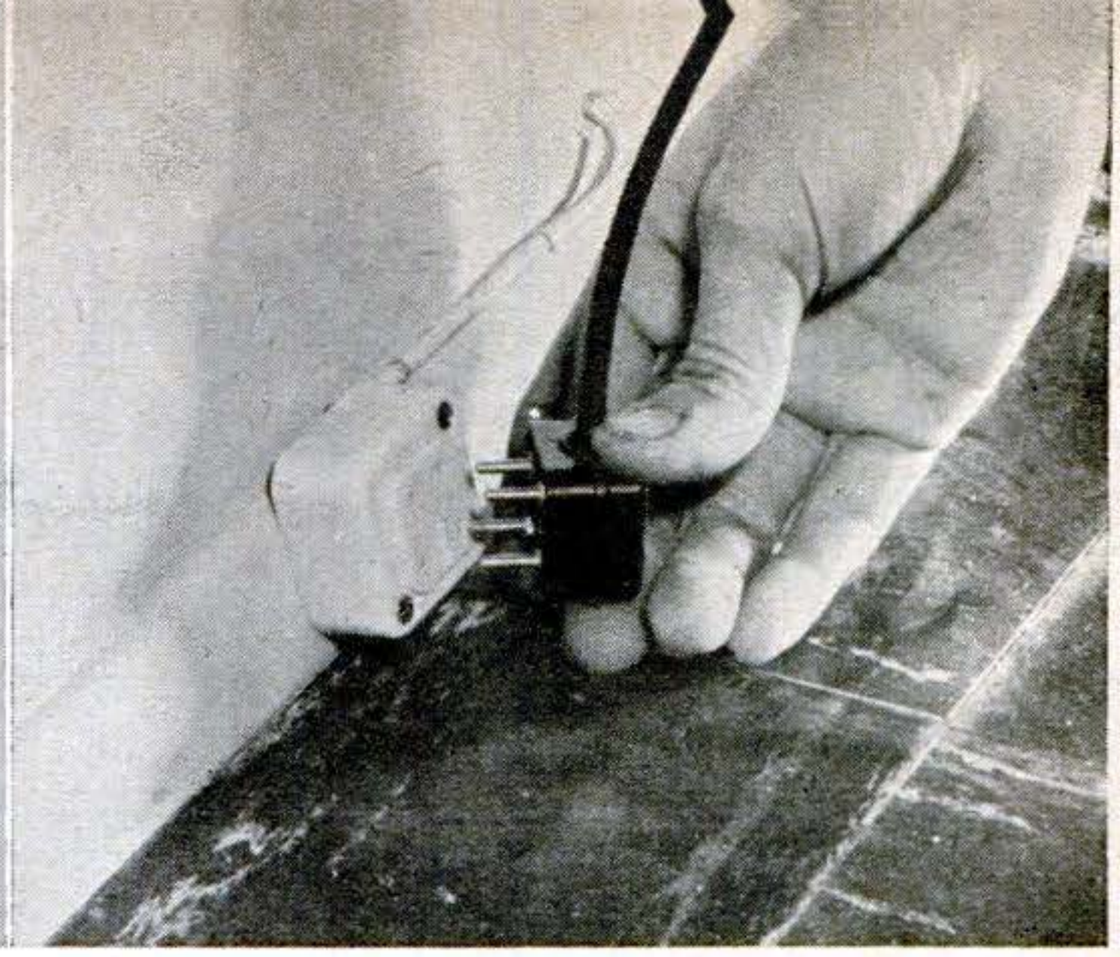
7 Another wire comes down through closet and out near ceiling to bell box, which is hidden in out-of-the-way hall corner. Above, Charlie identifies wires by listening to characteristic clicks before making final connections to box. He will also check by calling operator.



8 This house has wall jacks with plug-in type of telephone that can be moved around, used wherever a jack is available. There are two jacks, one in dinette and one in bedroom (above). Notice that only a few inches of wire show on bedroom wall, rest being concealed inside wall.

9 The telephone man makes the first call, asking the operator to call him back. In this way he makes sure that number is correct and bell rings properly. He prints number card with stamping device that is part of his kit and snaps it into place on the faceplate of the telephone.

10 The job is finished and Charlie can clean up, pack his tools, and leave. The average installation takes about two hours, so that Charlie and Joe can usually complete four jobs in a working day. Notice the neat appearance of the wiring on the outside of the house.

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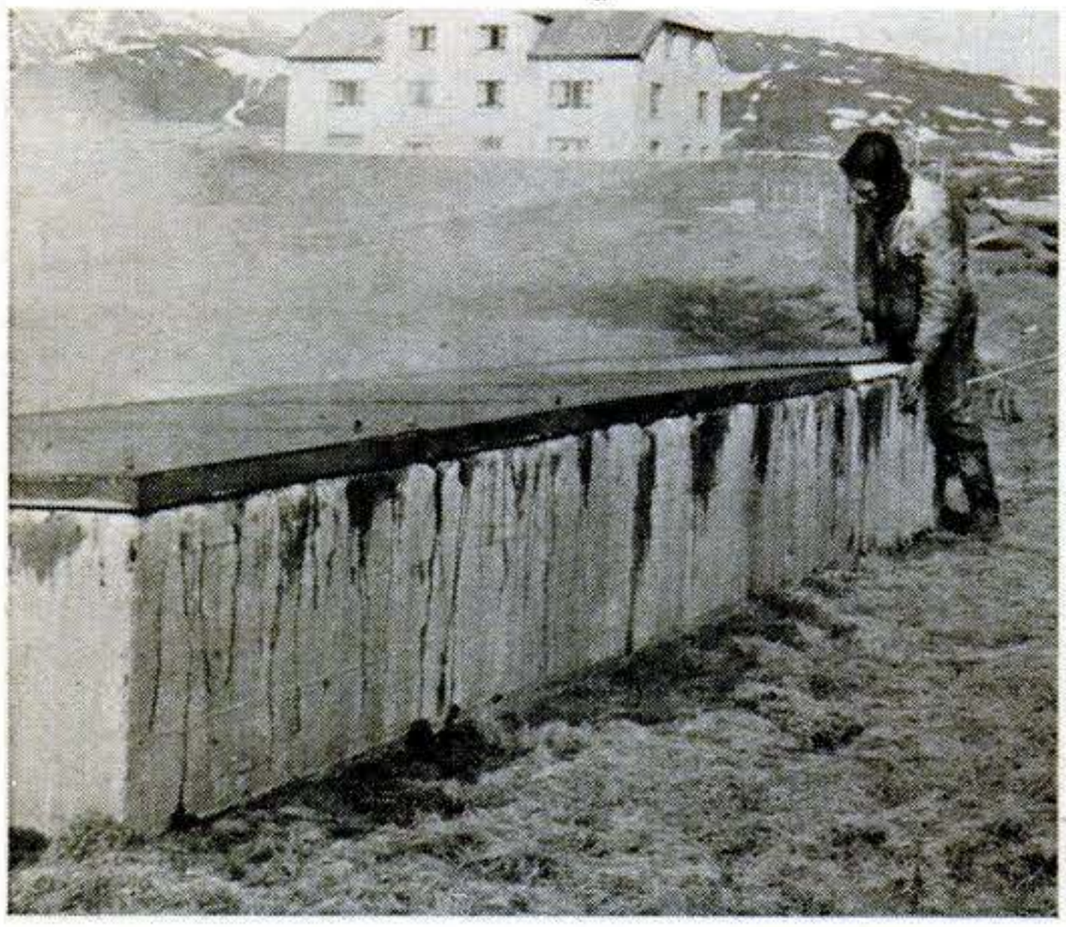
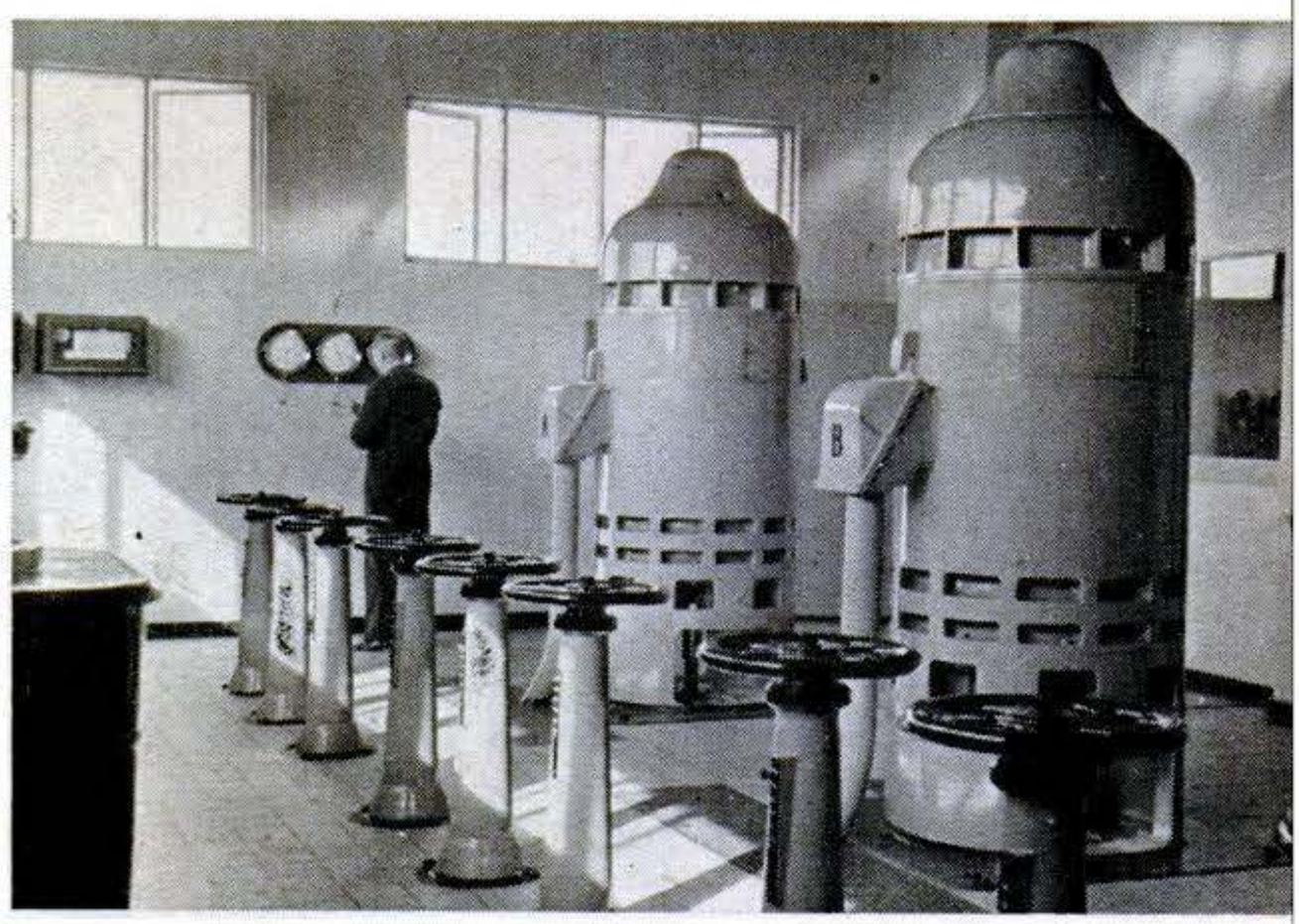
Nature's Hot Water Piped to Iceland's Capital

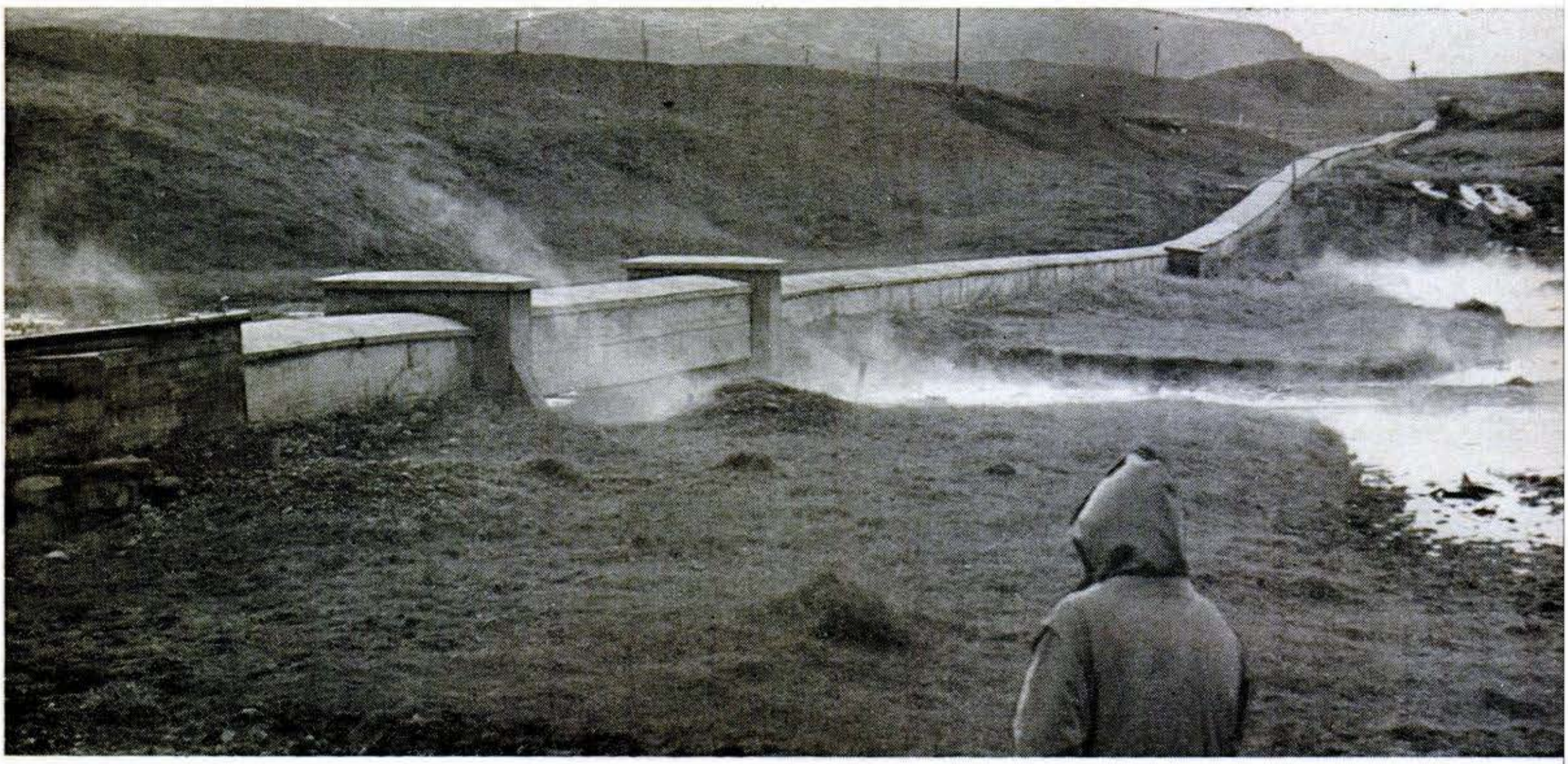
HARNESSING natural hot water that bubbles from the ground promises to turn chilly Iceland into an Arctic paradise. A unique central heating system, started in 1930 and recently completed, taps only a few of the hundreds of hot springs that dot the island. Yet the scalding flow, pumped overland, now provides the capital, Reykjavik, with 85 percent of its hot water. Users pay by meter. Plans are also under way for using the natural steam jets for the production of electric power.



1 Hot springs have been used by the women of Iceland for washing for hundreds of years. Now at Reykir there are 43 wells like the one above, some as deep as 2,500 feet.



2 At main pumping station, the water—almost entirely free of objectionable minerals—is filtered, then pumped through twin 14-inch insulated pipes to Reykjavik.



3 Concrete conduits cross a mist-laden field in which hundreds of small geysers shoot up from subterranean volcanic pockets. Pipelines carry 81 gallons of water per second.

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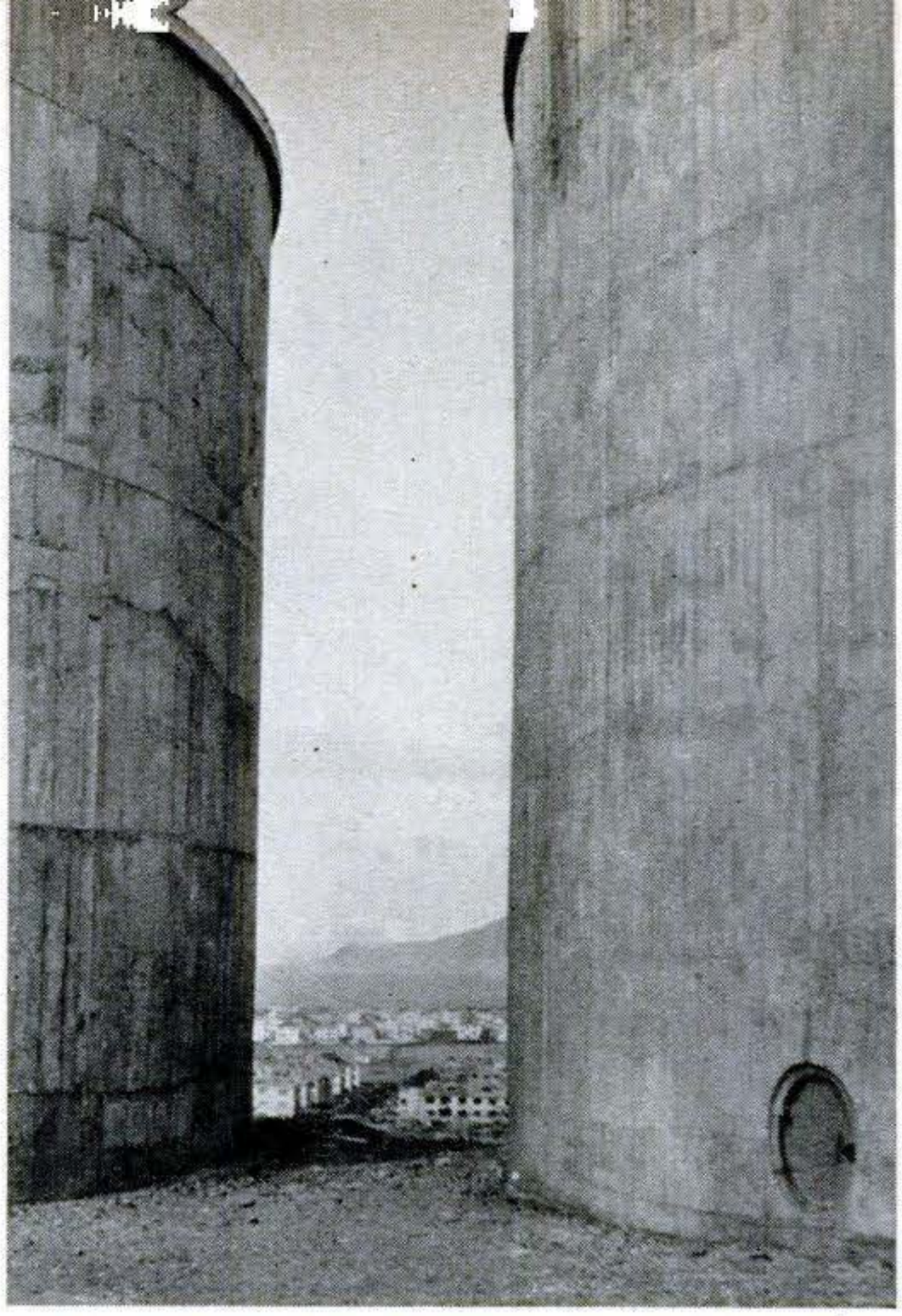
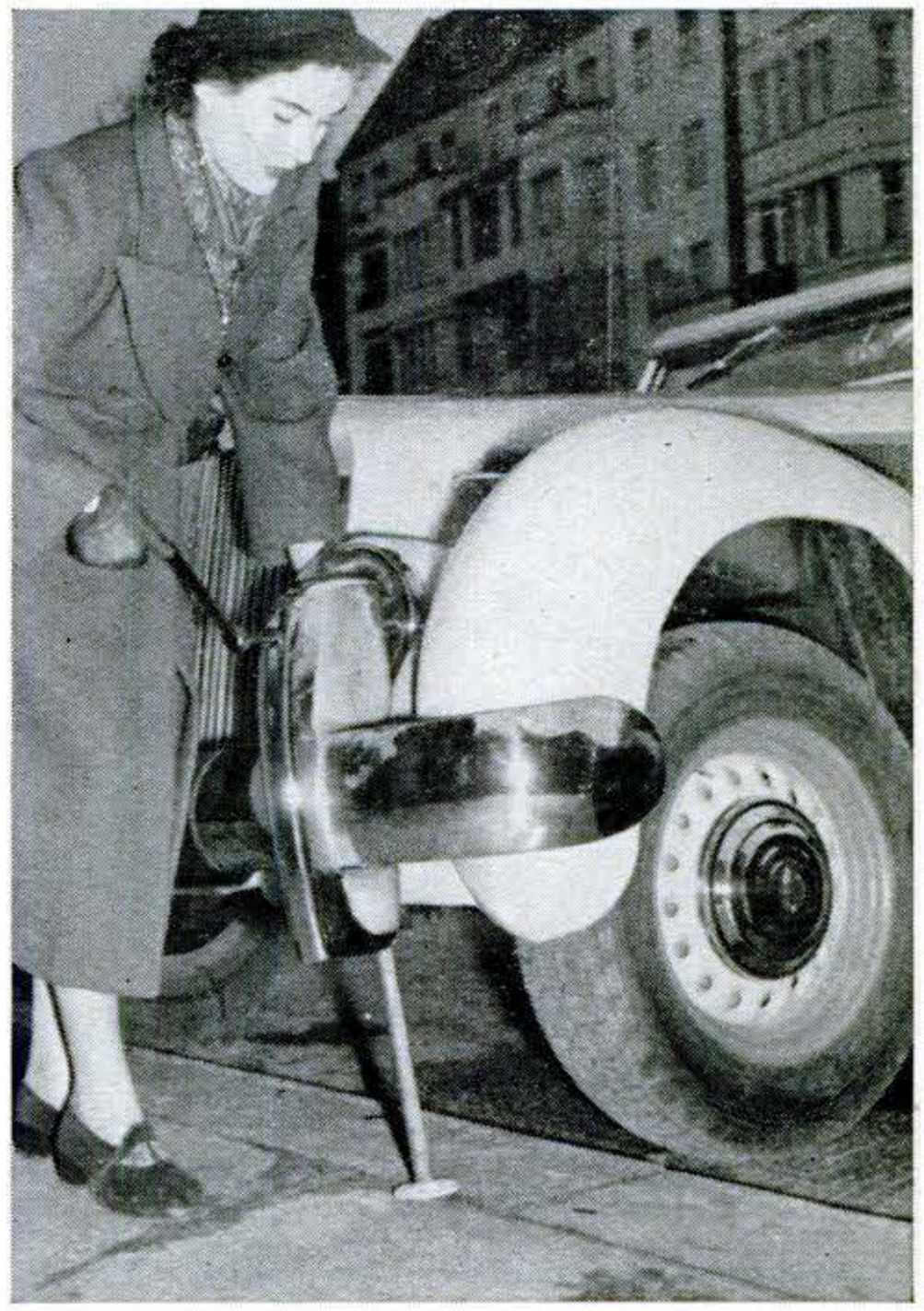


4 Seven circular concrete tanks store hot water on a hill overlooking the capital. Almost boiling at the springs, the water loses only a few degrees on its 10-mile journey.

5 Flowers and vegetables flourish in water-warmed greenhouses. Experiments have been so successful that even bananas have been grown less than 200 miles below the Arctic Circle.

Jack-in-Bumper Raises Car Wheel

DEVELOPED by a German inventor, a new wheel-raising method consists of four separate jacks built into the car's bumper guards. Each jack is operated by turning a handcrank that extends a rod downward against the ground, as shown below. If necessary, all four wheels can be lifted off the ground at the same time.



Spotlight Plugs into Lighter Unit

THE hand spotlight below plugs into a car's cigarette lighter, and can pick out a signpost at more than 1,000 feet. Made by the Arrow Safety Device Co., Mount Holly, N. J., the unit is compact enough to store in the glove compartment. It has an extension cord (inset) long enough so it can be used as a trouble light.

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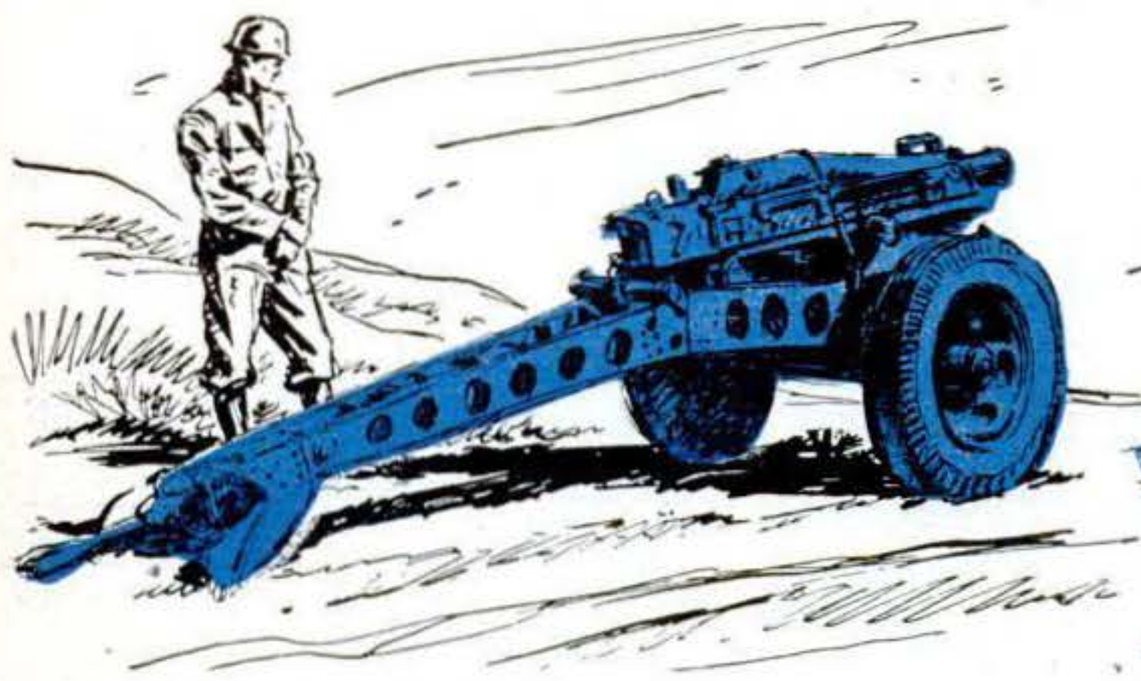
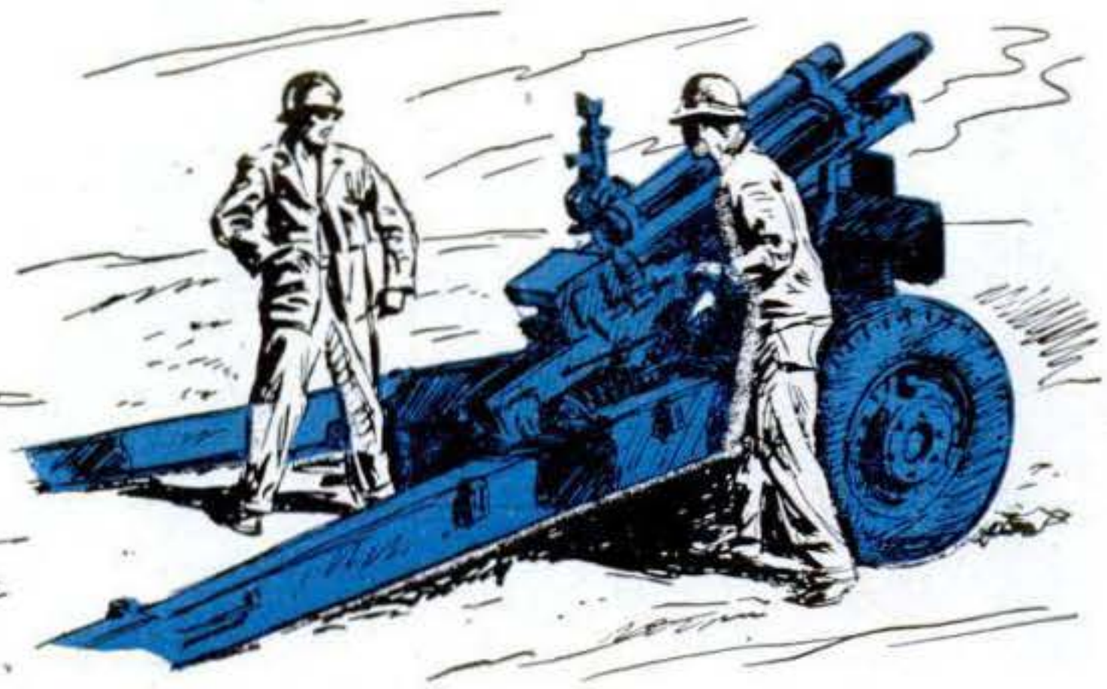
How to Tell the Guns

A 105-mm. howitzer crew somewhere in Korea prepares to lob one out in front of the infantry.



75-mm. pack howitzer is a deadly little peashooter that tosses a 14½ lb. shell more than 5½ miles. It's used by airborne units, was originally designed for fighting in mountains.



Army has more 105-mm. howitzers than any other cannon. It fires a 33-lb. shell at ranges up to 7 miles, can be towed up to 35 m.p.h. on good roads. Basic weapon of infantry division.

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from the Howitzers

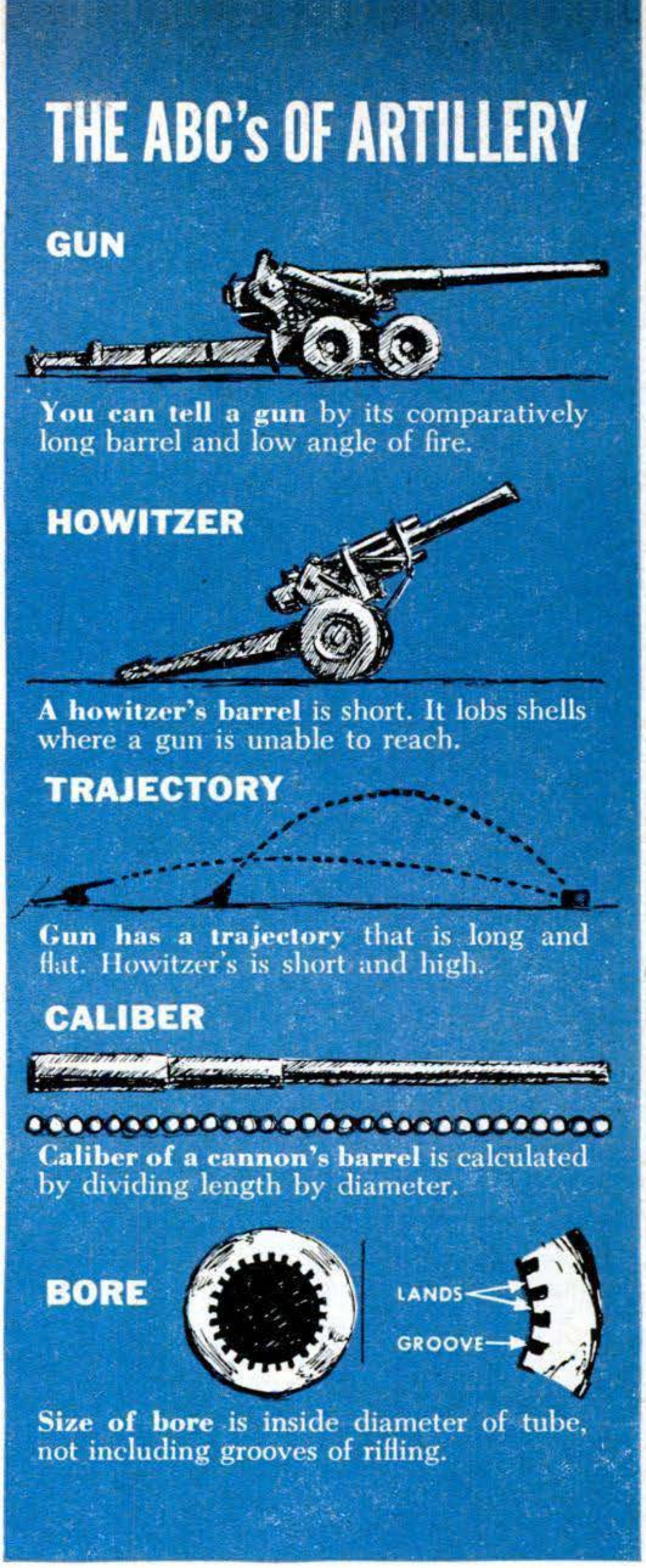
Mass destruction on wheels, the field artillery still rolls along, the big noise behind and ahead of the infantry.

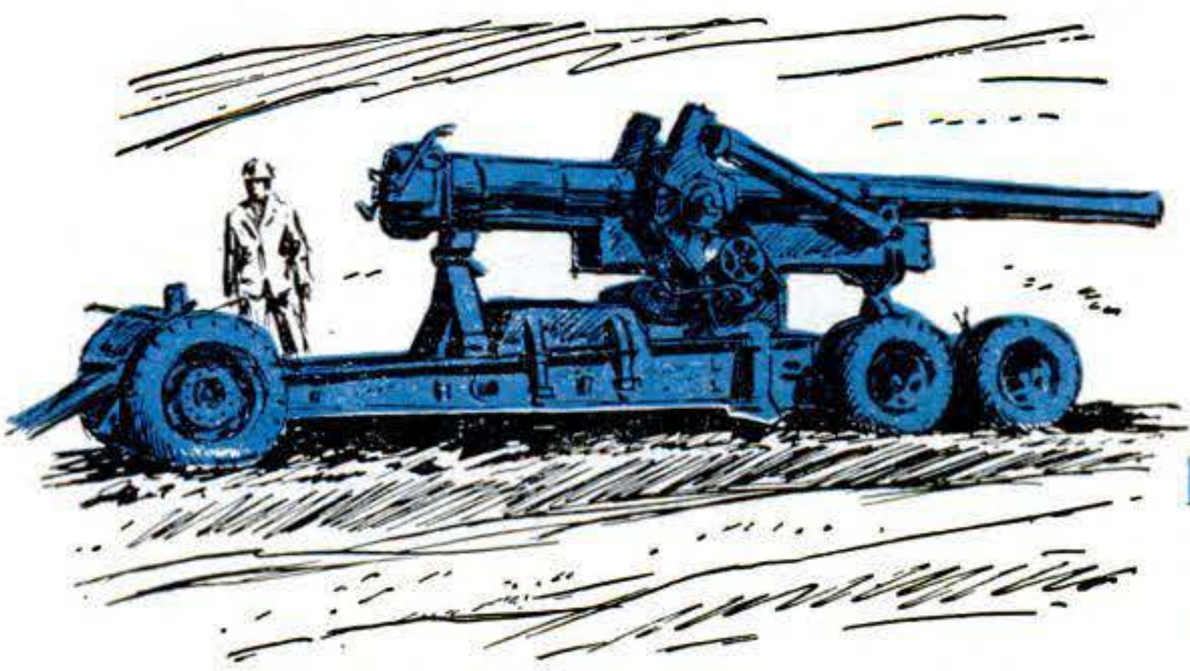
By John F. Loosbrock

NO WAR correspondent in his right mind spends much time with the artillery. The noise boys work in the dirty end of the death factory, in a bang-clang business which hits the headlines only when it suddenly becomes the front lines. And it draws enemy fire like flies to a dead horse. It's not a comfortable spot even for a deaf man, what with the stench of smoke and sting of burning powder grains.

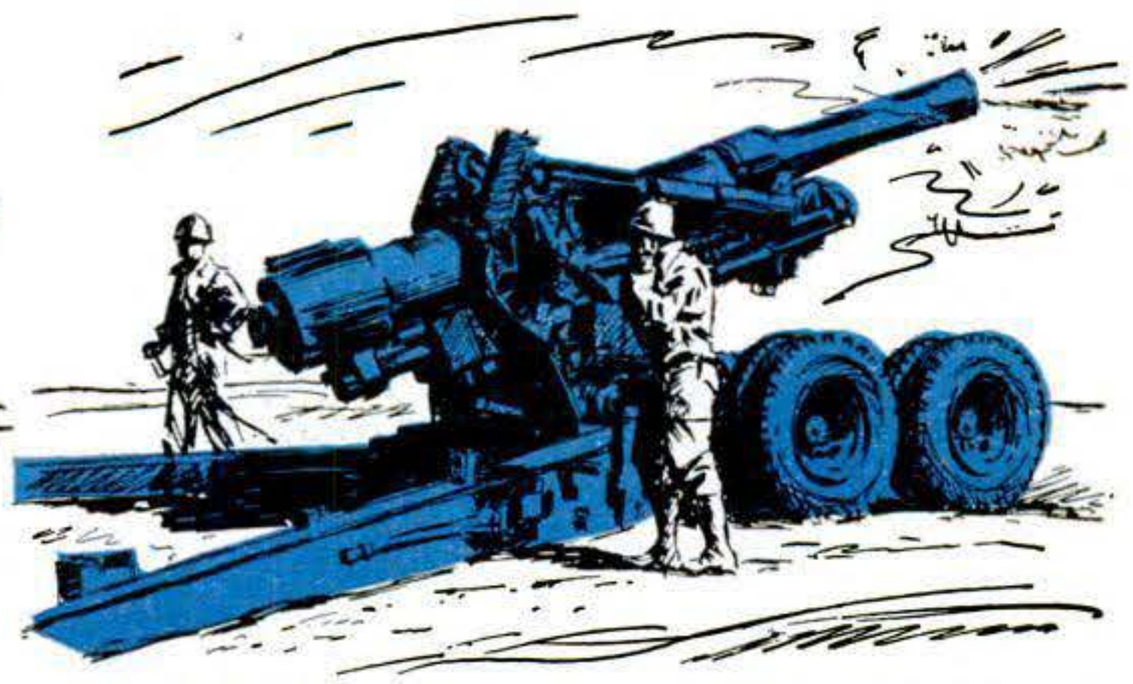
So you don't read much in the papers about the artillery. But you can bet your combat boots it was there, or you would have read much worse news about the infantry, the tanks, and the planes. The field artillery is always in there banging, brother, and it makes news only when it isn't.

The boom-boom business is closer to an efficiency expert's dream than any other kind of shooting-to-kill. It's a complicated combination of muscle and mechanics, with a little chemistry thrown in. Every shell must be muscled from ammo dump to gun —and every round let off with due consid-





Famous "Long Tom" of World War II is the 155-mm. gun. It's shown here in traveling position for towing behind truck or tractor. It can drop a 96-lb. shell on a target 16 miles away.



The 8-inch howitzer is probably most accurate artillery piece the Army owns. It can drop a 200-lb. shell in your hip pocket from more than 10 miles away, and do it every two minutes.

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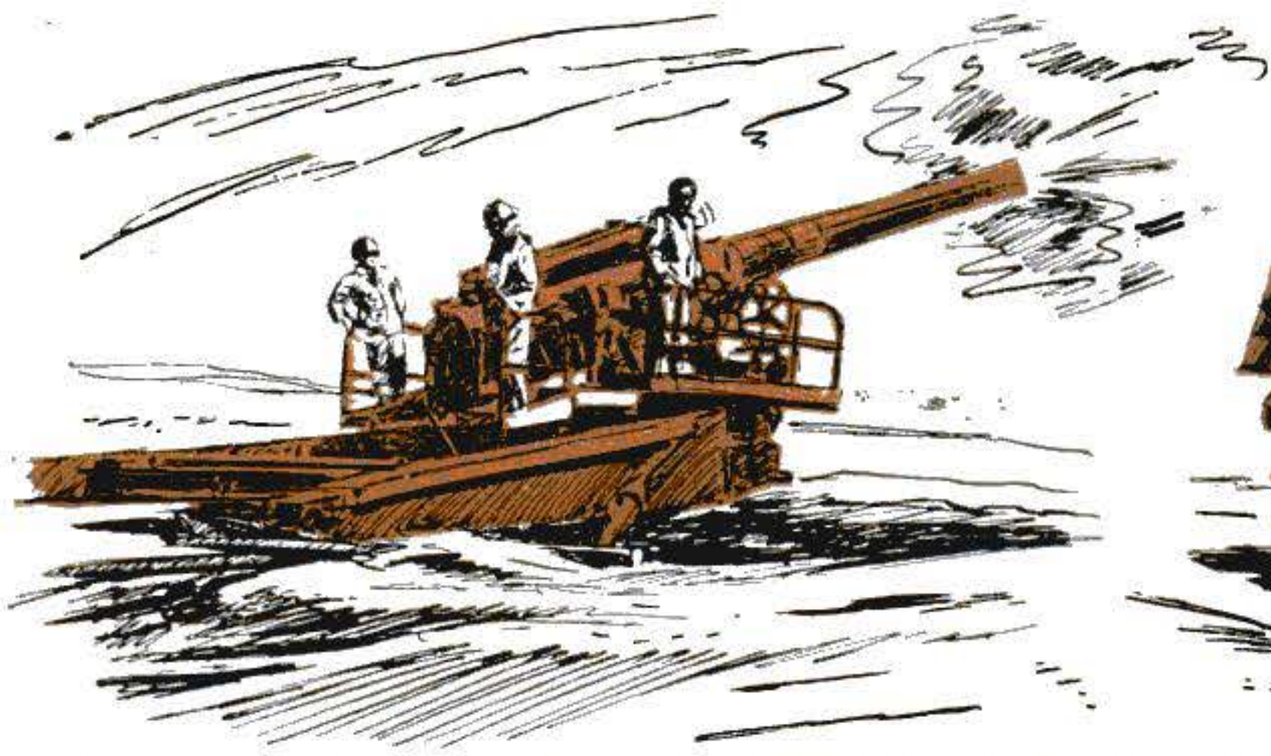
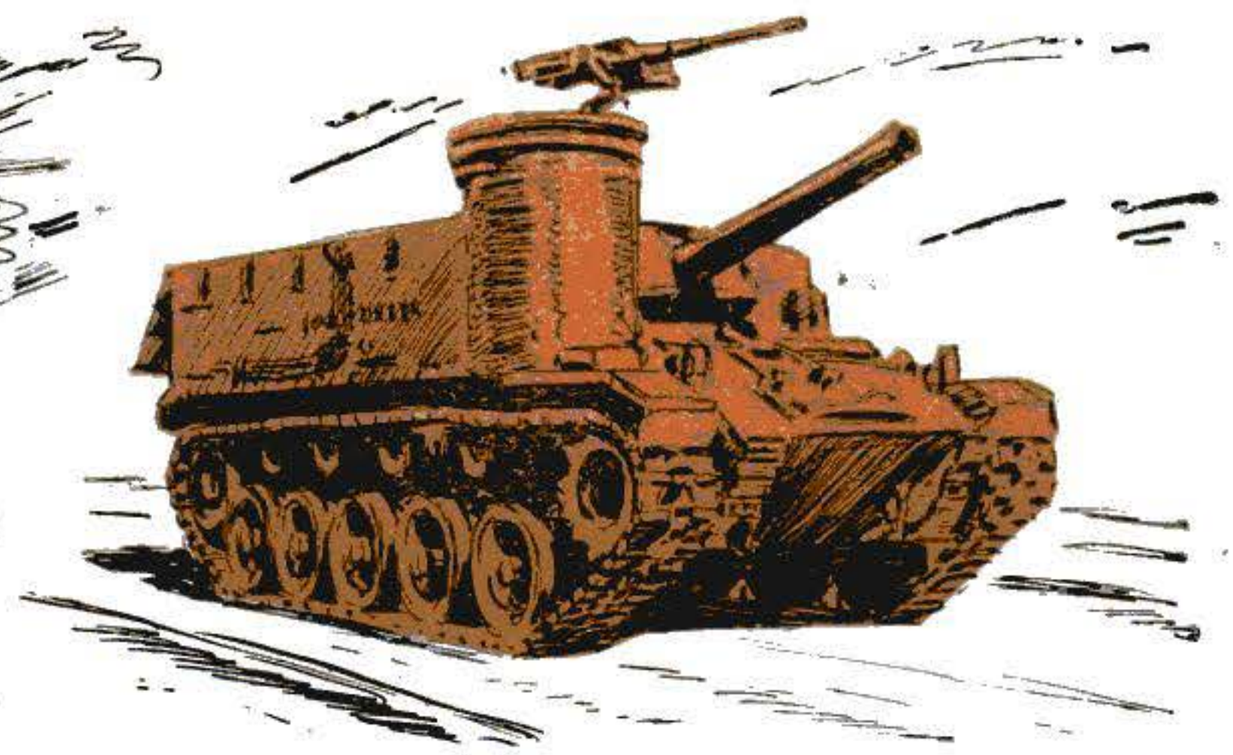


Heaviest Army artillery shell, 360 lb., is fired by the 240-mm. howitzer. Like most big jobs, it breaks into two sections for towing. Sketch shows cannon and crew at moment of firing.



Self-propelled 105-mm. howitzer is mounted on a full-tracked motor carriage. It's used primarily in armored divisions, although eventually Army hopes SPs will replace all towed cannon.

eration for different kinds of targets, range, weather, and even powder temperature. That's why every battery includes an ordinary thermometer in its complicated linkage of steel, gunpowder, mathematics—and strong backs.

Artillery weapons themselves don't seem to have changed much. That's because, like the turret lathes, millers, presses, and other weapons of industry, they have been developed over years and even centuries. They are the machine tools of mass destruction, and like all machine tools, they've absorbed, in their screwturns of constant improvement, the advances of hydraulics, chemistry, electronics, and mathematics.

Guns vs. Howitzers

Actually, the term artillery takes in a lot of ground—mortars, rocket launchers, recoilless cannon, and antiaircraft pieces. But field artillery as such, and that's what we're talking about, comes in two distinct varieties—guns and howitzers.

Gun, of course, is a generic term applied to all firearms. But in its restricted and technical artillery sense, it's a cannon with a relatively long barrel (30 to 50 calibers* or more), with a high muzzle velocity and a flat trajectory, or angle of fire. The howitzer barrel is comparatively short (20 to 30 calibers). Its muzzle velocity is low, trajectory is high. It can lob shells over hills that would block targets from a gun. By the same token, the *gun* can reach out and hit targets that would be beyond the range of the howitzer. And the gun's higher muzzle velocity lets it damage targets that the howitzer couldn't hurt if it could reach.

That's because of the gun's longer barrel. A gun of a given size and using the same powder charge will throw a shell harder than a howitzer. An Army Ordnance expert explains it this way, "You can get more velocity in two ways. Kick the shell harder or kick it longer. With a long barrel you kick it longer."

Artillery bore sizes are reckoned, with one exception, in millimeters. They range from the 75-mm. pack howitzers issued to airborne troops to the mighty 240-mm. gun. In between are the 105-mm. howitzers, the 155-mm. and 8-inch in both guns and howitzers, and the 240-mm. howitzer. Figure roughly 25 millimeters to the inch for an idea of size.

More about sizes later. Now let's talk about another artillery classification. A cannon can be towed by a truck or tractor, or self-propelled on a tank-like mount.

At first glance the self-propelled (SP) jobs would seem to be superior. Armored divisions use them to support fast-moving tanks. But infantry divisions have relied on the towed cannon and a lot can be said in their favor.

True, the SPs have the edge in speed. They can begin firing in a matter of minutes after they clank into position. The bigger towed guns take hours to emplace. But, say the towed cannon advocates, the self-propelled cannon is chained to its prime mover. Lose the vehicle and you've lost your cannon. It can't be manhandled into position if necessary. And a tracked mount is more complicated mechanically than a truck—plus the fact that a separate truck can

* *Caliber, in artillery, applies not only to the diameter of the bore, as in rifle and pistols, but also describes the ratio of barrel length to bore diameter. Thus a 50-caliber cannon has a barrel whose length is 50 times the diameter of the bore.*

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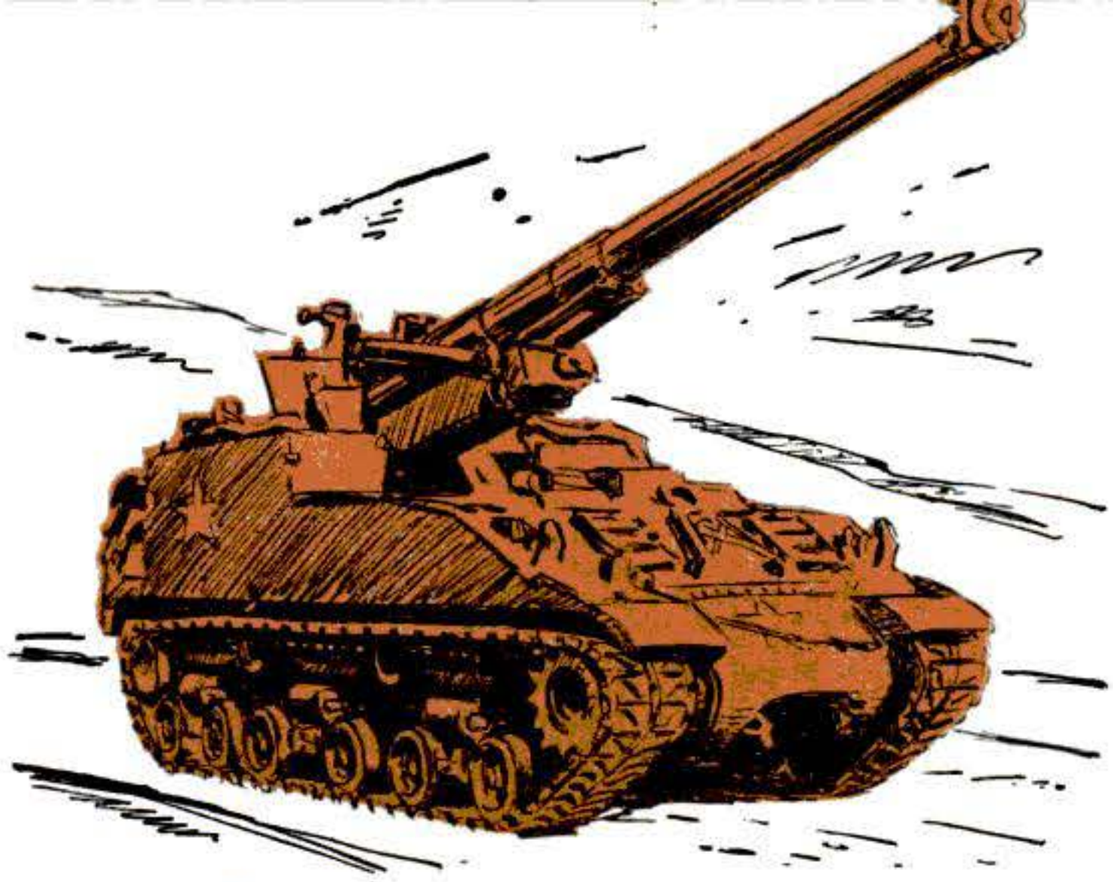
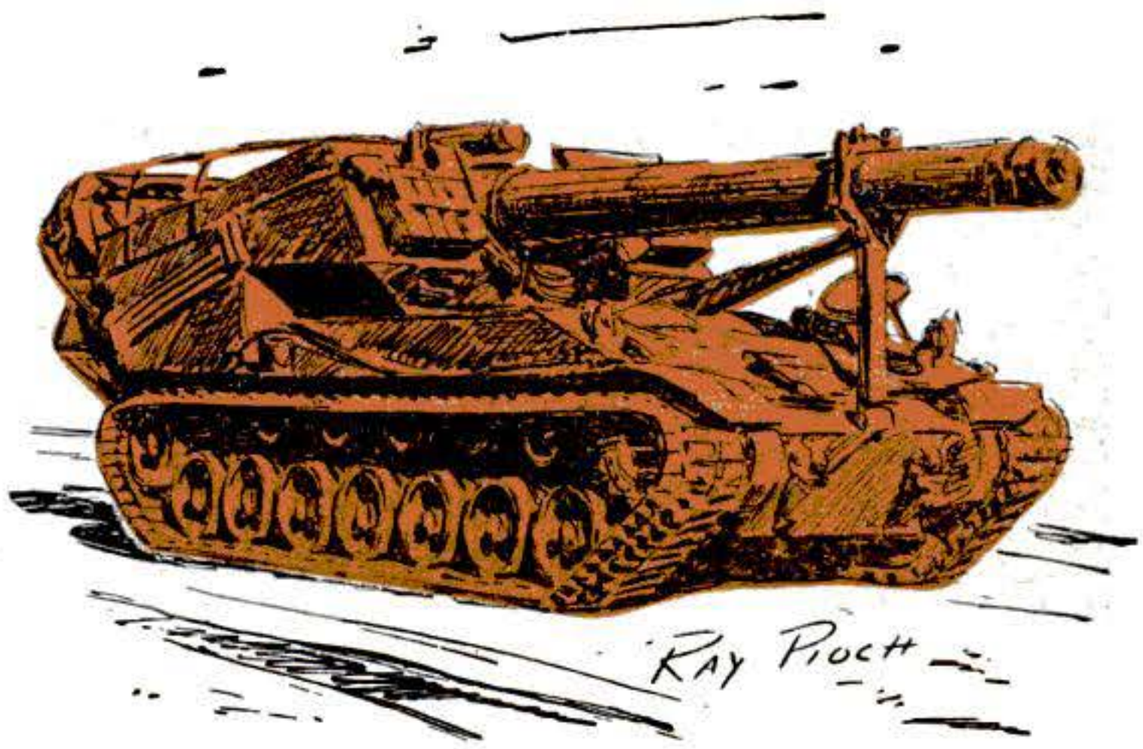


Mobility of self-propelled 155-mm. gun coupled with its high muzzle velocity, 2,800 feet per second, makes it an excellent direct-fire weapon against tanks and fortified positions.



Big advantage of self-propelled jobs is speed. Even this giant 240-mm. howitzer can begin firing within minutes after clanking into position. A towed cannon often takes hours to emplace.

haul ammo or chow while its gun is firing.

Nevertheless, after a careful study, the official Army line calls for eventually self-propelling all artillery. But don't look for it to happen soon. Converting to tracked SPs runs smack dab into the tank procurement program which now enjoys top priority.

Artillery ammunition varies in type according to the size of the weapon. The small stuff, 75s and 105s, fire what is called semi-fixed ammo. (A rifle fires a fixed round. That is, the cartridge case and bullet are permanently fastened together until fired.) In a semi-fixed round, the powder is contained in a metal case separate from the projectile. That's so you can vary the charge according to the range. The powder comes in cloth bags, with the basic charge, or "charge one," doughnut-shaped to fit around the primer in the base of the shell case. The remaining charges, up to seven, vary in size, look like beanbags. Firing tables accompanying the ammo tell what charge to use for a given range. You detach the excess charges, if any, and fit the case and projectile together for loading.

Bigger cannon, from the 155 on up, both guns and howitzers, fire separate-loading ammo. The projectile is loaded separately, followed by the powder in cylindrical cloth bags. There's no metal shell case.

Projectiles, too, vary in type according to what you're shooting at.

High explosive (HE). The most common. Its comparatively thin walls of forged steel are filled with TNT. They splinter into killing fragments when it explodes.

High explosive antitank (HEAT). The famous shaped-charge shell, used against armor and reinforced concrete (PS, Oct., '50, p. 98).

Chemical shells. Contain toxic or irritant gases, or smoke-producing phosphorus.

Illuminating shells. Contain a parachute flare ejected in mid-air by a time fuze. The parachute slows the flare's fall enough to light up a suspected battlefield area.

Armor-piercing shells. Primarily fired by tank and antitank guns. Field artillery sometimes uses them for fire against tanks.

Artillery fuzes, too, vary according to what you're aiming at. In general, their classifications are:

Impact: Either point-detonating, to go off the moment it hits, or delay, to go off at a predetermined time after impact. The latter lets the shell penetrate a bit before it explodes to get at dug-in troops, pillboxes, and the like.

Time: Can be set to explode at a predetermined time after firing. The idea is to get aerial bursts over protected troops.

Proximity (VT): A sort of foolproof time fuze. In its nose is a tiny radio set, from which radio waves are constantly emitted. When these hit a object and bounce back to the fuze, the shell explodes.

Artillery is distributed through the Army according to the job it has to do. Workhorse of the artillery is the 105-mm. howitzer. It's the basic artillery arm of the infantry division, distributed in three battalions of three six-gun batteries.

Each infantry division also has a battalion of 155-mm. howitzers. It usually helps support the regiment having toughest going at the moment. Really big stuff, 155-mm. guns, 8-inch guns and howitzers, and 240-mm. howitzers are controlled at corps or army

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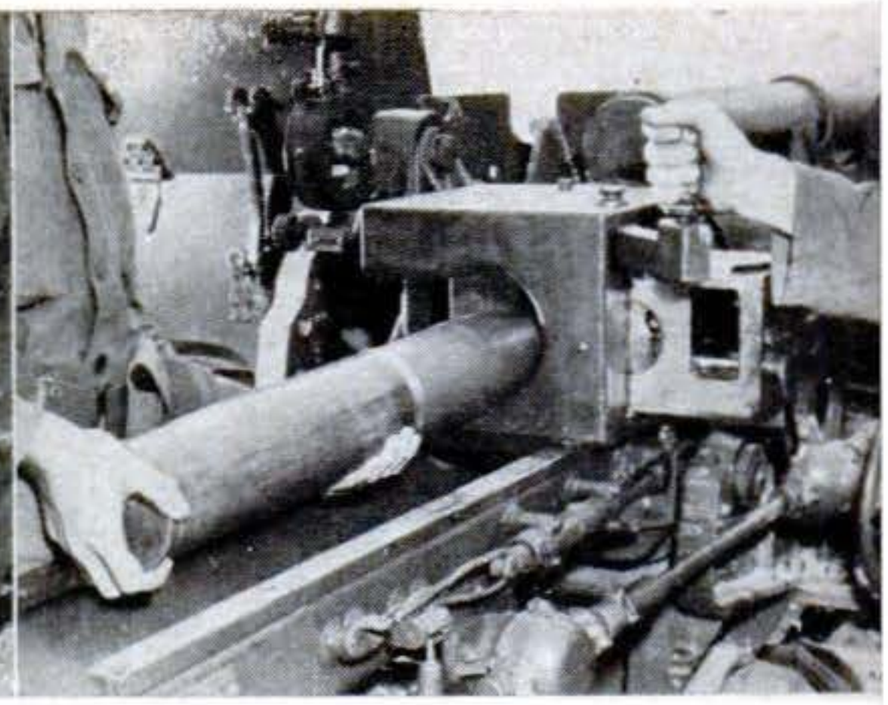

Workhorse of the field artillery is the 105-mm. howitzer, shown here being loaded and fired. Semi-fixed ammo (left) includes projectile, shell case, and seven charges of powder. Amount of powder used is determined by range. Excess charges are detached (center) and projectile fitted into case for loading. Breechblock (right) is horizontal, sliding-wedge type.

level. They do artillery's other big job—firing at the enemy's artillery, called counter-battery fire.

For counter-battery fire, of course, the ancient rabbit-stew recipe holds true. First you have to find your target. Artillery does this in a number of ingenious ways—by the sound of the cannon, by the flash of its fire, and by using radar. Sound and flash equipment works from two or more known points on the ground and picks up the location of enemy batteries by triangulation.

Radar is a little trickier, and to date is effective only on slow-flying mortar shells. The shell flight is tracked and traced backward through its trajectory to its source. Similar equipment to locate faster-moving shells has high research priority.

What's coming up in the artillery field is largely a matter for speculation. One high-priority project is the lightening of field pieces for airborne use. This involves the substitution of light metals like magnesium and titanium for steel. The airborne people would also like a heavier cannon than the 75-mm. pack job—maybe a 105 or larger that would fold for dropping.

Self-propelled cannon will be improved. A drawback thus far has been the limited angle of elevation, due to the tube hitting the floor of the carriage during recoil. One solution would be improvement of the variable recoil devices now used on some weapons. These shorten the recoil distance as the angle of elevation increases. Another big step would be a turret mount, like a tank, allowing 360 degrees traverse, firing in all directions without moving the carriage.

But the biggest artillery boom of all is still unharnessed. That would be the wedding of the atomic bomb with the artillery shell. Veiled hints have been dropped that this is not too far off. And when and if that day comes, you'll see a more thorough revision of strategy and tactics than A-bomb makers ever dreamed of. END

Separate-loading ammunition is fired in big cannon. Powder is loaded separately—there's no shell case—in cloth bags (left), in increments according to range. Projectile for 8-inch gun (center) weighs 240 lb., is carried on loading tray by four men. Tray fits onto end of loading ramp. Heavy shell is pushed up ramp with rammer, shoved into chamber (right).

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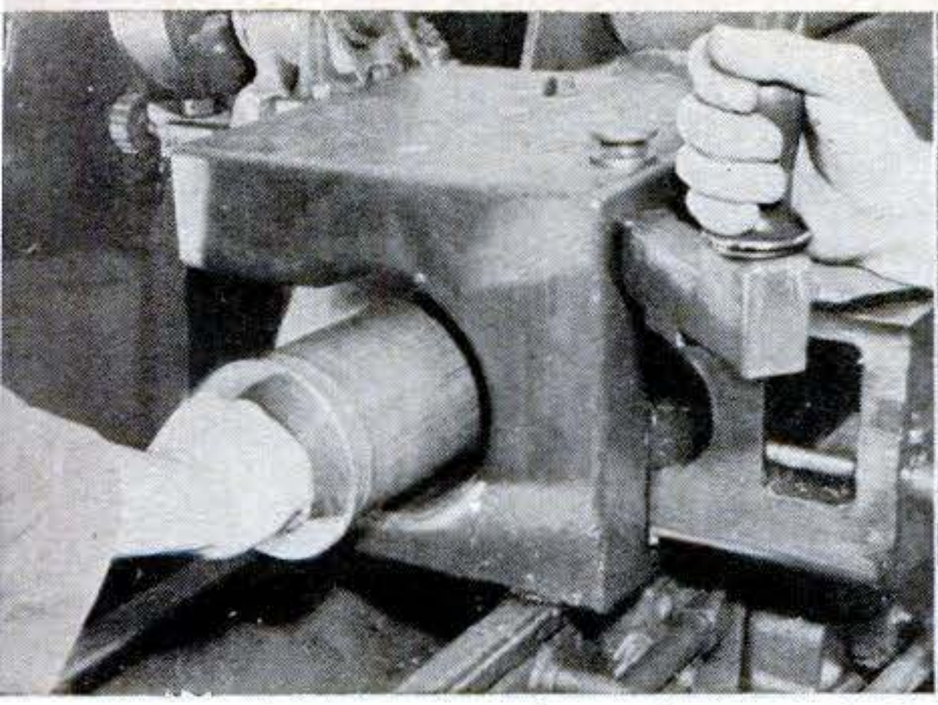
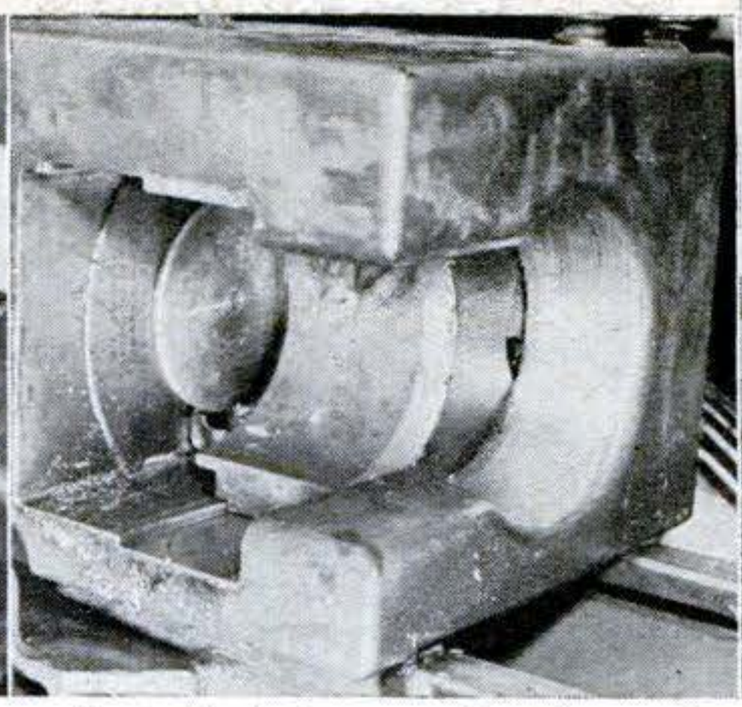
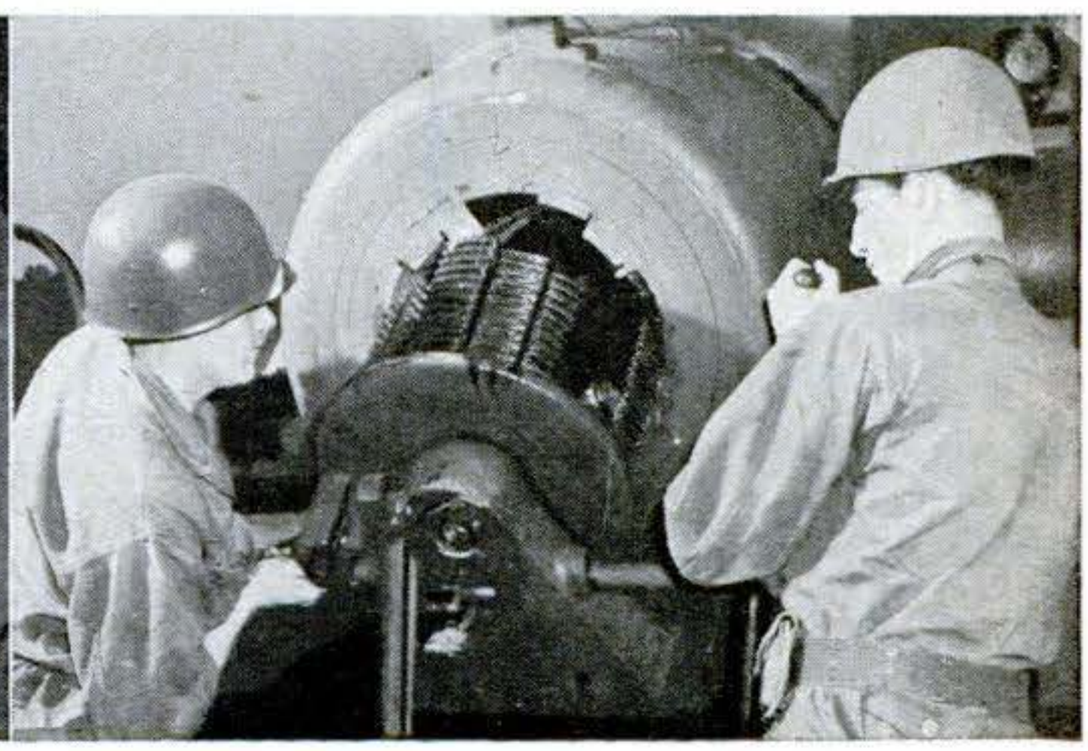




Cannoneer slams home shell with balled fist to avoid pinched fingers (left). Breechblock (center) is beveled on forward edge. Bevel forces round into chamber, wedging action seals off tube. One pull on cord, called lanyard, cocks and fires the piece. First part of pull compresses firing spring, rest of movement disengages sear, forces firing pin against primer.

If you figure roughly 25 millimeters to the inch, you'll get an idea of the sizes of these shells.

Powder charge, weighing 106 lb. for maximum range, is loaded directly into chamber. It can kick the big projectile more than 20 miles. Firing pin and primer are contained in interrupted-screw type breechblock, which is shown below being shoved into place (right). Long-range guns like this one are used against enemy artillery and fortifications. **PS PHOTOS BY W. W. MORRIS**



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Fertilizer Dropped from the Sky

FORTY tons of lime, phosphate, and nitrochalk recently fell from the sky upon the countryside in a mountainous district of Wales during a two-day British demonstration of large-scale aerial fertilizing. Especially fitted for the purpose, a big Bristol plane showed in eight flights how vast areas of inaccessible and neglected land could be transformed into fertile farm land.

Light planes have long been used effectively for crop dusting with chemicals to control insect pests. Aerial fertilizing has also been tried on a small scale. For the past two years, the New Zealand Air Force has been making experimental drops of pelleted superphosphate fertilizer from a one-ton hopper slung beneath the fuselage of a Grumman Avenger. Success of these trials led to the new large-scale method.

A Bristol Type-170 Freighter was chosen for its large capacity, low operating cost, and ability to operate from grass fields or short improvised runways. It was fitted with a six-ton hopper, operated by one man in the fuselage. Simple mechanical controls avoided problems of servicing hydraulic or electric systems in remote areas. Accompanying photos show the resulting fertilizer plane in action.

Ground party watches plane scatter tons of fertilizer. Second man from left has walkie-talkie set and is directing operation by radio instructions to pilot.

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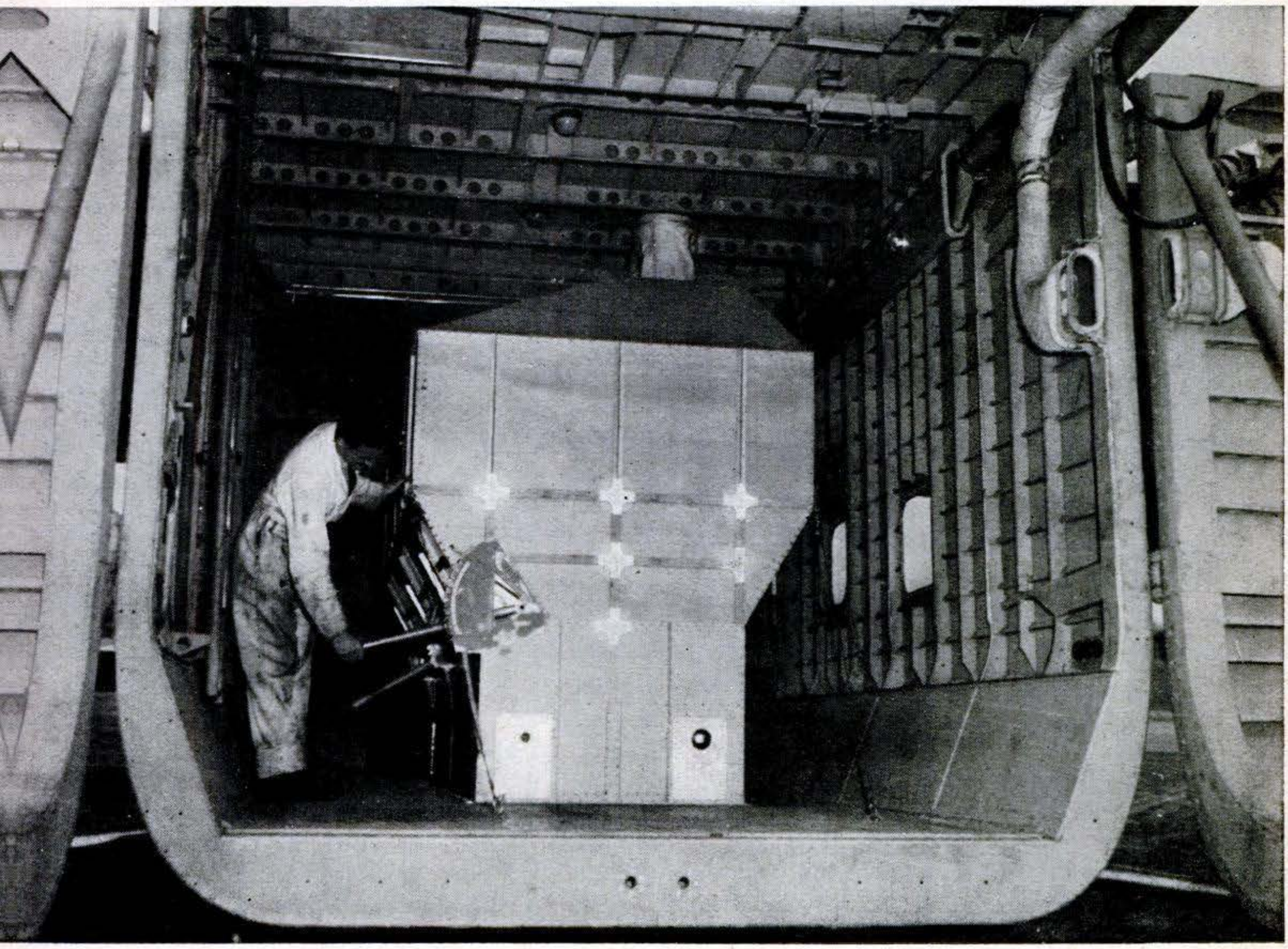
Before flight, big Bristol freighter plane is loaded with fertilizer. Crane supports funnel-like device from which material feeds by gravity through tube into hopper within the plane.

After flight, a Welsh farmer examines pellets of lime thickly strewn from plane over "target" area. In other successful trials, plane scattered phosphate and nitro-chalk fertilizers.

Fertilizer hopper in big plane has six-ton capacity. Man in picture is holding one of release levers that open shutters, in apertures beneath hopper, to discharge contents in flight. Different kinds of fertilizer may be placed in three compartments of hopper, and released simultaneously to give any desired mixture of chemicals for fertilizing the ground below.



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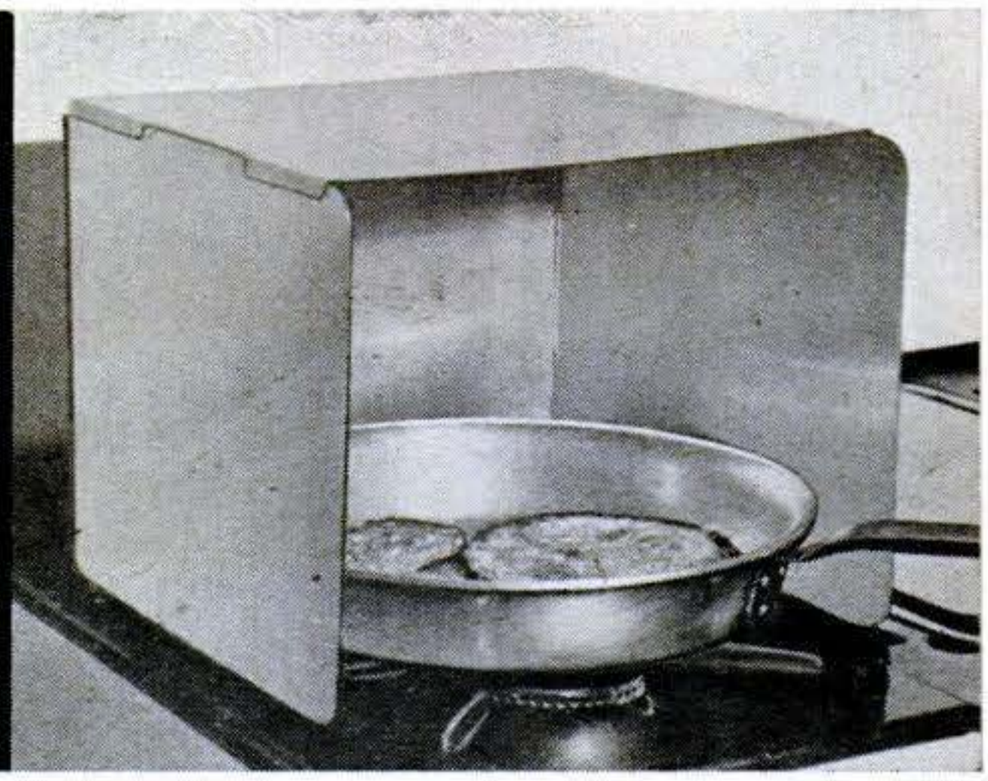
Aids to Modern Living

Cutting Board Fits Lap. Sewing and cutting jobs are easily handled at lap level with this stiff board. Constructed so that fabric pieces can be pinned to its surface, it has inch markings in a grid pattern for aligning materials. Measuring 20 by 37 inches, the board is priced at $1.29 by John Dritz & Sons, New York City.

TV Seat Is Inflatable. When Junior sits on this one-pound plastic-balloon hassock to watch television, suction causes it to grab the floor or carpet. When deflated, the stool can be folded for storage. Plastictronics, Inc., New York City, sells it for $2.50.

Liquid Unsticks Adhesive. Squeezed from a flexible plastic bottle, a new liquid, called Quit, loosens adhesive bandages so they can be removed without pulling a patient's skin. Patron Chemical, Los Angeles, makes it.



Shield Catches Grease. Propped around a frying pan, the spatter shield above has a top for keeping bacon warm while eggs are cooking. It unfolds for use as a cookie-baking sheet. Mrs. Letha O. W. Cordrey, San Diego, Calif., sells it for $1.50.

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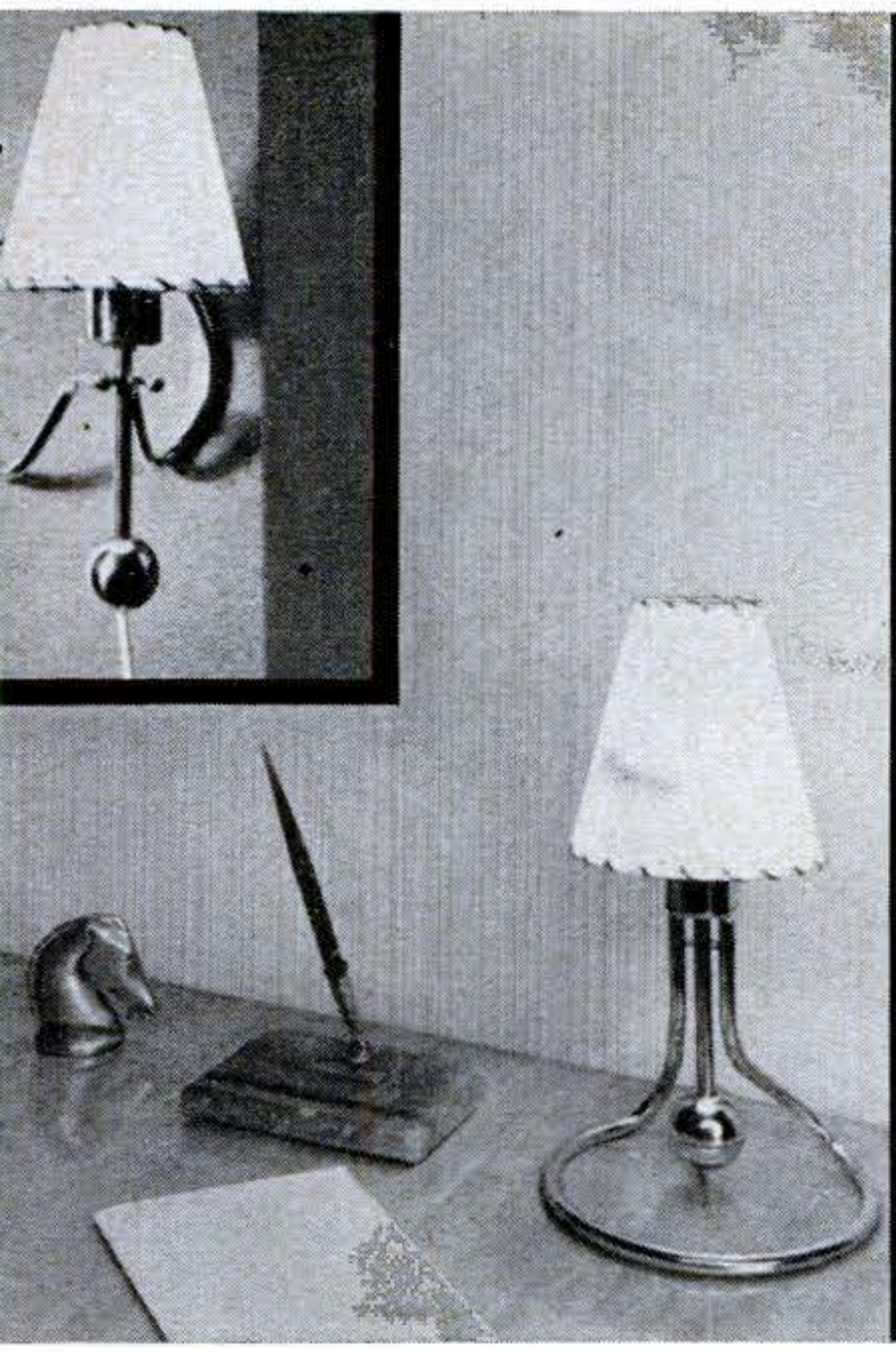
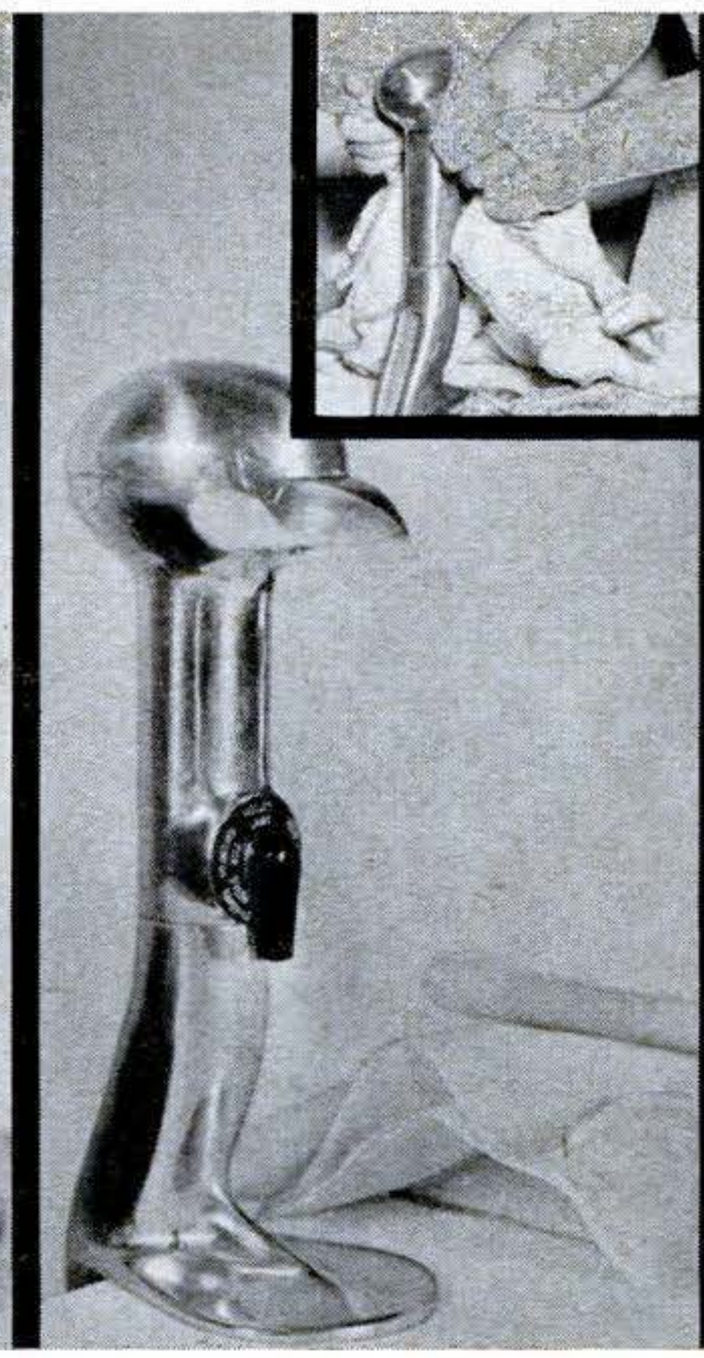
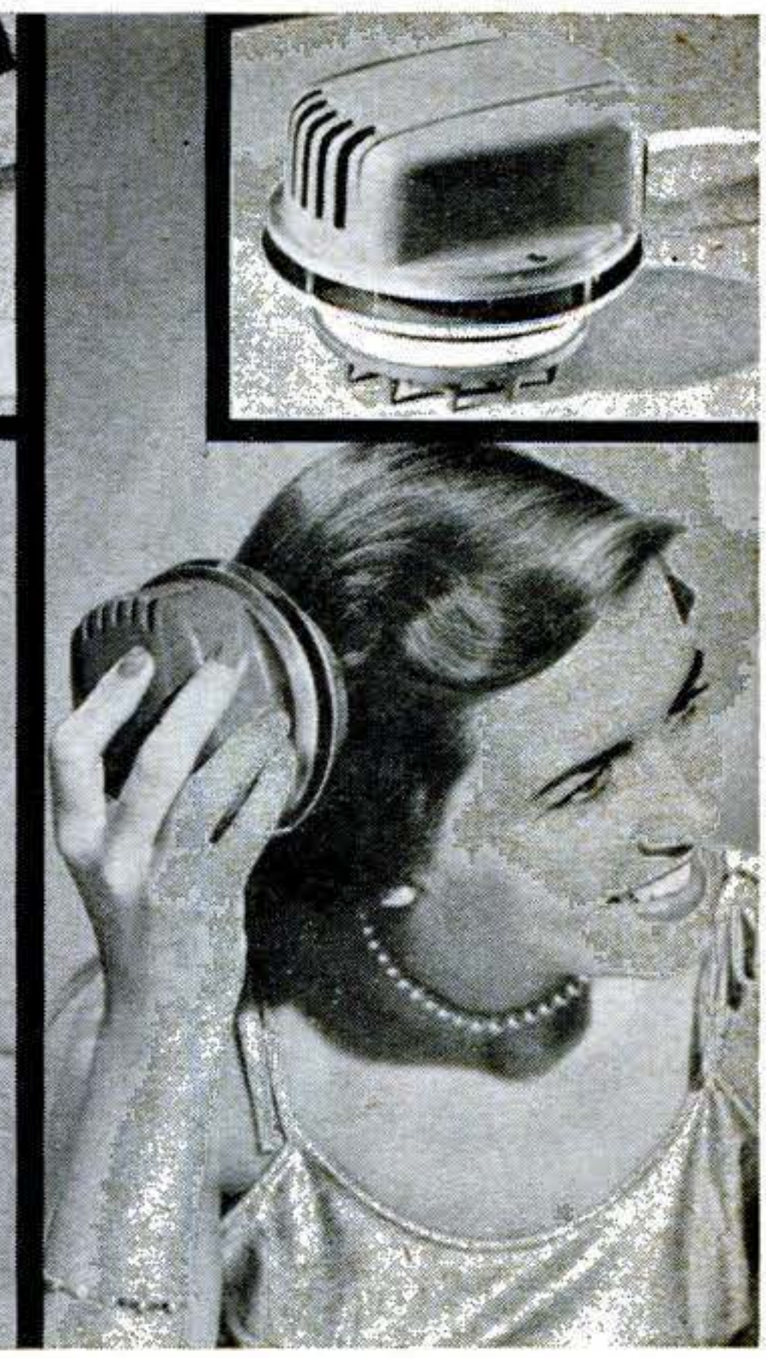


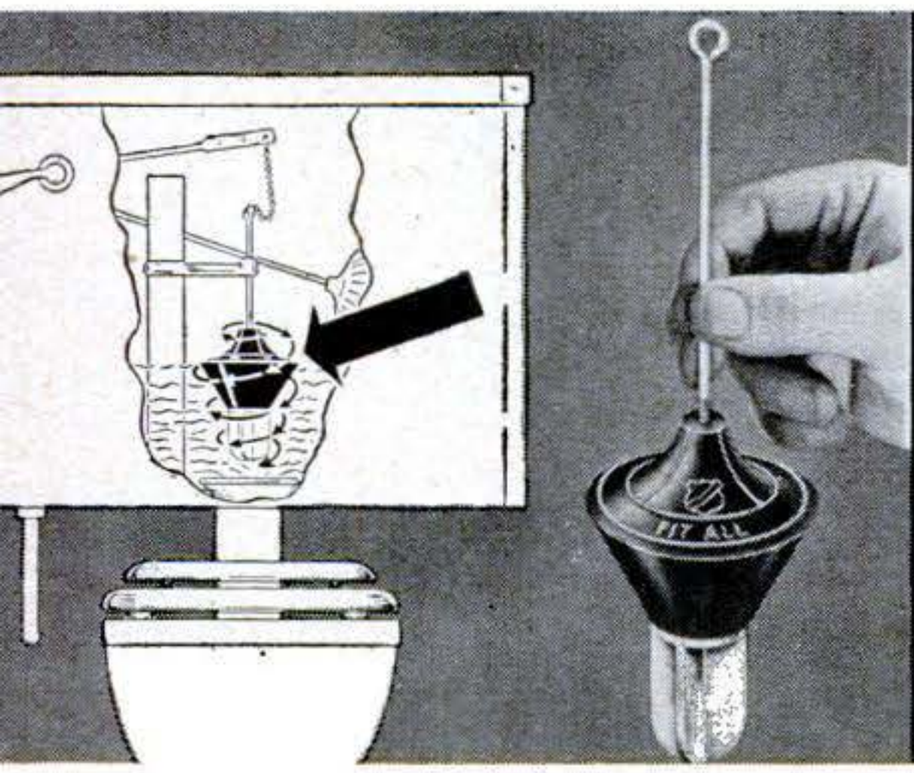
Desk Lamp Is Also Wall Light. This brass lamp has a pendulum-like shaft that pivots so it can stand on a desk or hang by its base from the wall. Imported from Italy, it is one of a collection of Italian lamps sold by Lightolier, Inc., New York City, for $19.50 and up.



Stationary Iron Clamps to Board. Resembling a long-necked bird, this electric iron presses ruffles, puffed sleeves, and other hard-to-reach places. Materials are drawn over its head and beak. Frank Meier, Inc., Menlo Park, Calif., prices it at $19.95.

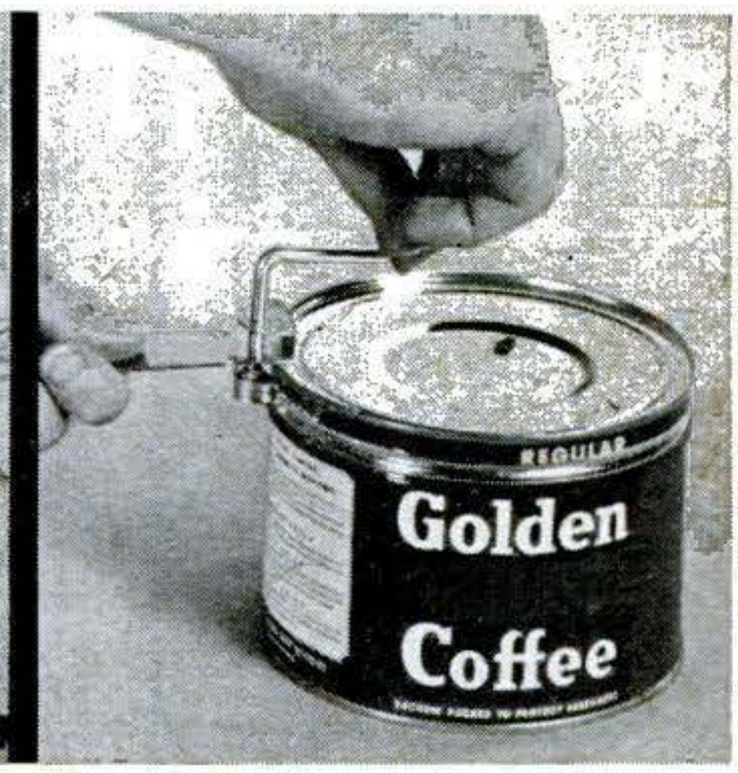


Vacuumer Cleans Hair. Plugged into an AC outlet, this hair cleaner loosens dirt and dandruff, then sucks them into a disposable filter. It has a rubber brush with vibrating fingers that massage the scalp. H. C. Paulk, Inc., of Topeka, Kan., sells Hair Vac for about $15.



Ball Cuts Water Waste. This tank ball and rod is said to put an end to running toilets. Fins cause the ball to swirl down to the valve seat during flushing. This results in seating that stops noise, water waste. Chicago Specialty Mfg. Co., sells it for 75¢.

Tape Marks Hem. Dressmakers can mark a hem in a minute with the tape-dispensing Hemaliner above, says the Macton Machinery Co., Port Chester, N. Y. As a customer stands on turntable, a wheel presses tape on skirt.



Crank Replaces Key. This crank-operated can opener winds the metal strip smoothly off a vacuum container. Just put the slotted end of the crank over the band tab and turn. Jifi Sales Co., Milwaukie, Ore., sells the re-usable, steel opener for 30¢.

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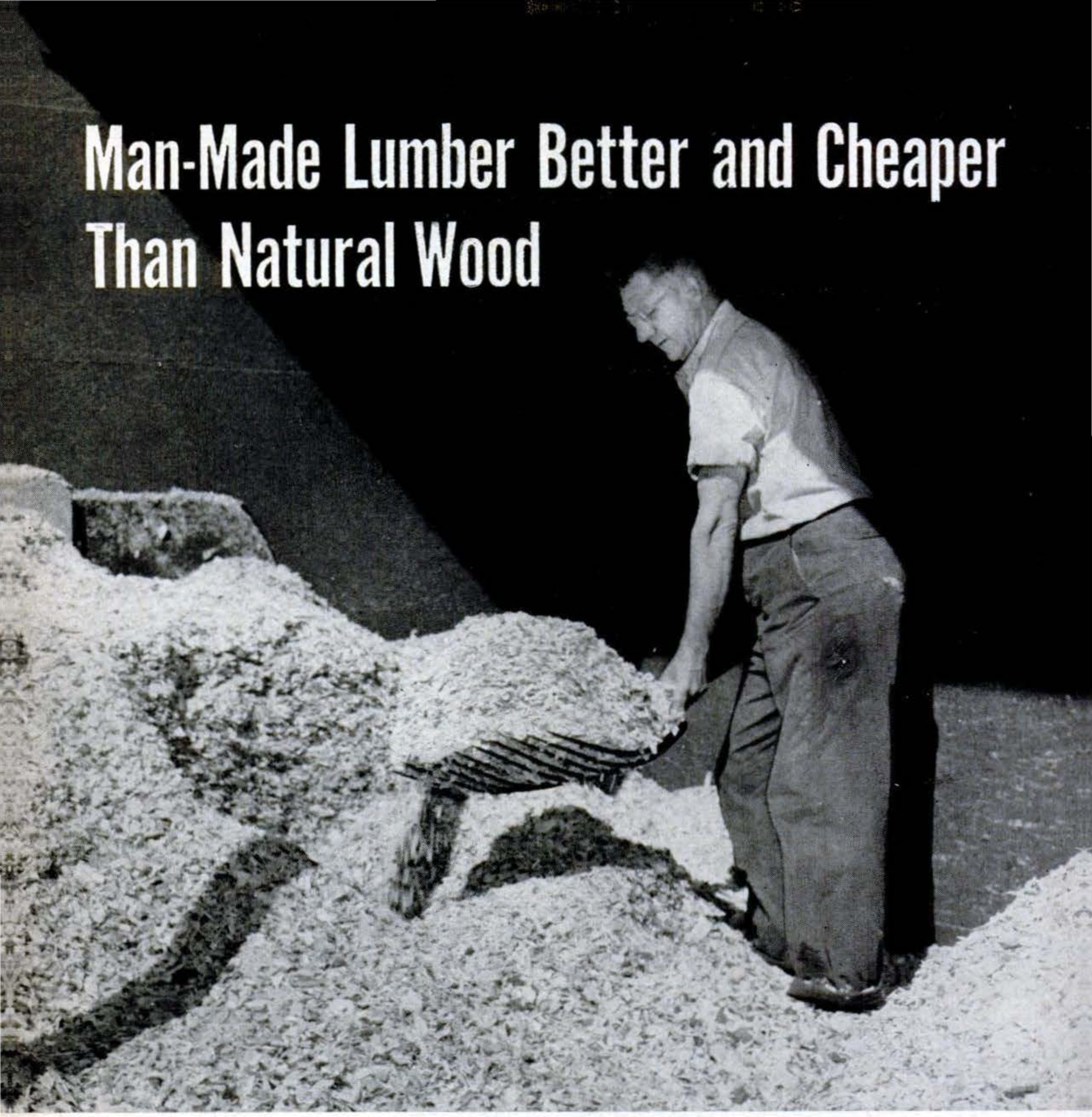
Man-Made Lumber Better and Cheaper Than Natural Wood



Chips of wood are forked into a spiral conveyer that leads to a grinder. Then the fine wood particles are blown into a big hopper over the mixing point. Softwoods are mostly used.

By Frank Rowsome, Jr.

PS PHOTOS BY HUBERT LUCKETT

A GOOD-SIZED New Hampshire factory is busy 24 hours a day at what seems, at first glance, like one of the world's silliest industrial operations: they grind up lumber into bits and remake it into lumber.

Far from being a boondoggle, it's an operation that may foreshadow major changes in several U. S. industries. Experts say that the process could some day make a sawmill plank about as quaint as a hand-wrought nail. It may reduce the amount that a new home will cost you, and it may substantially enlarge U. S. timber resources.

Synthetic lumber—which is ground-up wood bonded with a resin under heat and pressure—holds this glittering promise because of basic defects in natural lumber.

The best conventional methods of changing logs to lumber are spectacularly wasteful. It's estimated that less than 30 percent of the wood in the log reaches the con-

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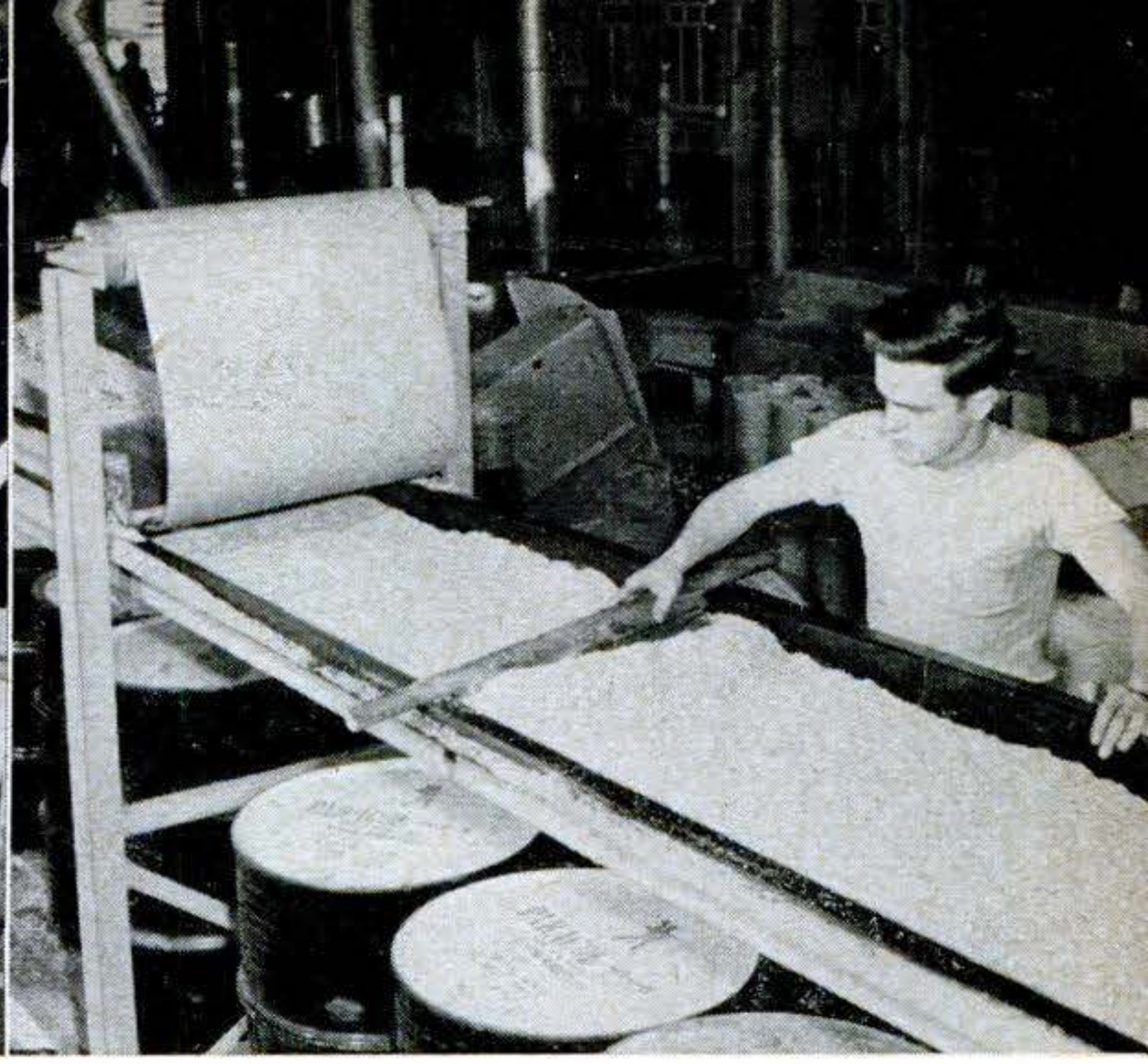
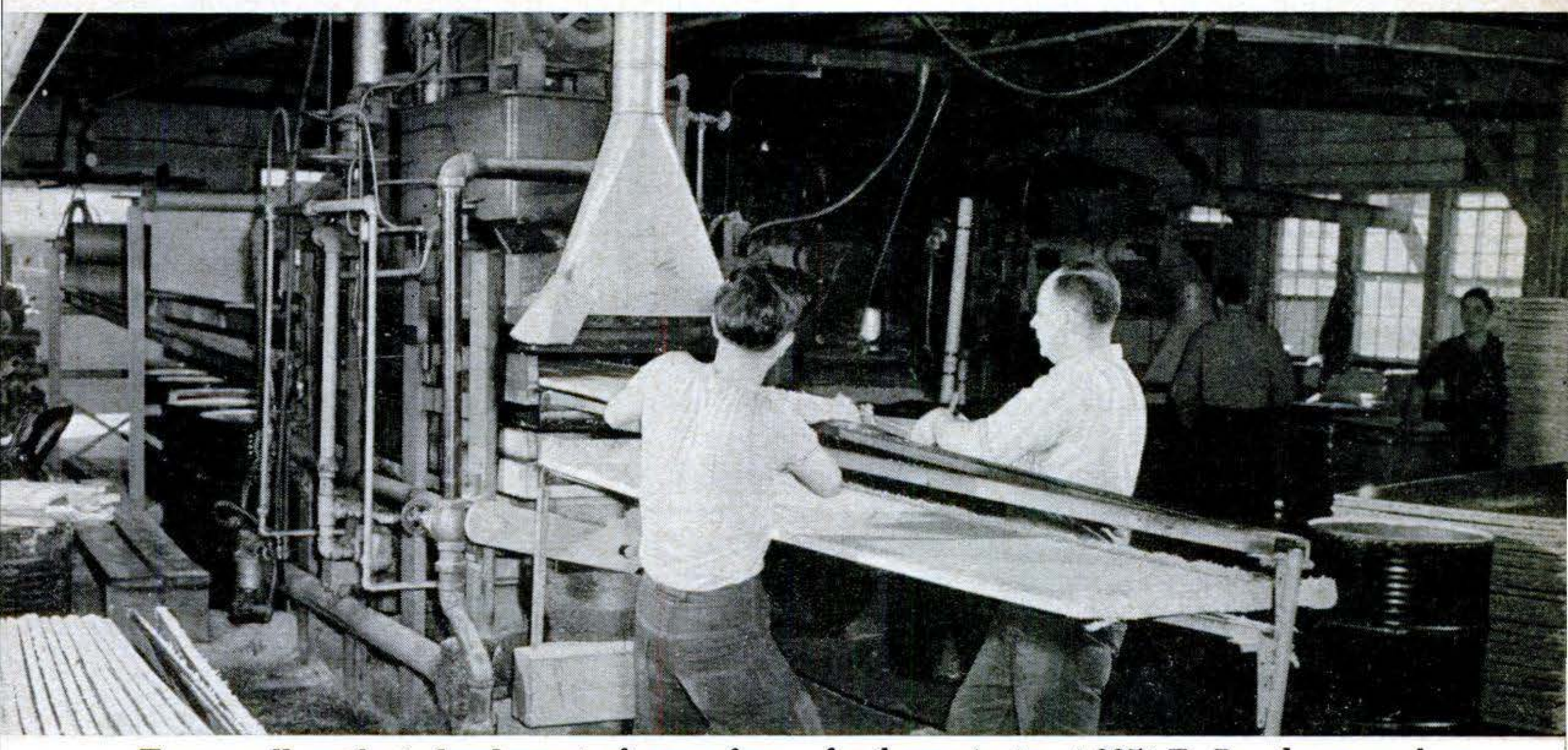
Sawdust-like mix of ground wood and resin powder pours into container as worker watches a scale balance. Mixer overhead continuously adds resin to wood in controlled proportions.



Paper makes a tray to carry the mix into the press. "Comb" in man's hand spreads it on paper while previous boards are cooking in press. This press makes two boards in each cycle.



Tongs pull synthetic lumber out of press after it has been squeezed at 200 lb. per square inch for three minutes at 325° F. Boards are run between paired bandsaws to trim off rough edges.

sumer as lumber. Even at that, a big part of this scant third is inferior grade. Moreover, the characteristics of natural lumber are mainly fixed—applications have to be governed by what nature built into the tree.

With man-made lumber, none of these limitations apply. Practically all the wood can be used, including logs that the boss sawyer at a sawmill would call hopelessly inferior. The product, too, is of uniform quality, with no loss from down-grading. Special characteristics that are needed—hardness, shear strength, moisture resistance, nail-holding power—*can be built in* at the mill. And because the process, compared to that of a sawmill, gives a far higher yield from cheaper raw material, synthetic lumber may even cost less.

The dream of turning wood fibers into a better board isn't in itself new; the immense waste between forest and consumer has long stirred men's imaginations. But until recently only the insulating and "hard" boards have made a place for themselves, and in

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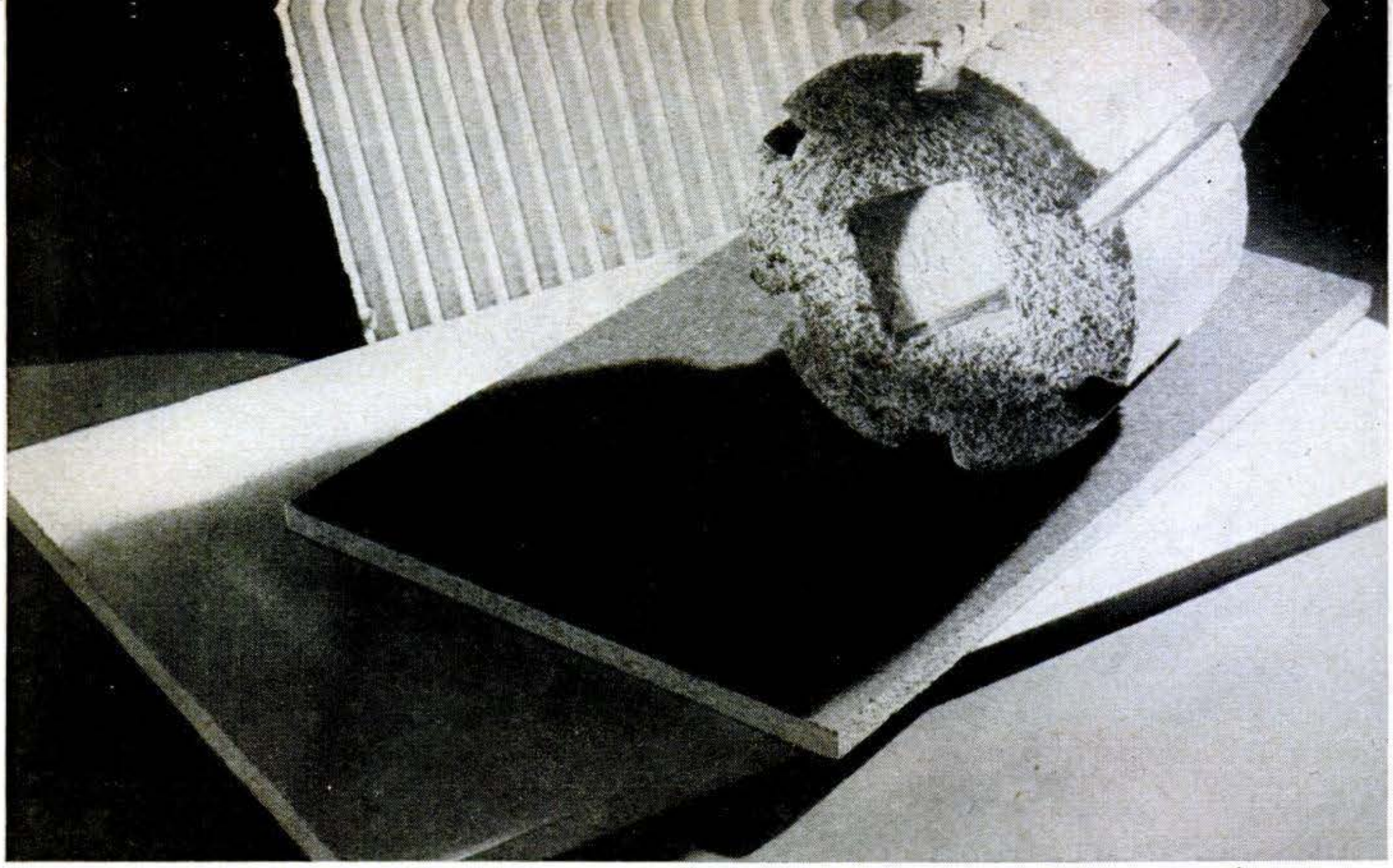

Synthetic lumber looks like this. Circular object is section of factory roller. Dark board is tile "underlayment"; light one is sheathing. Corrugated material in back is experimental.

both cases physical limitations and manufacturing costs have been restraints. (The principal difference between the older "felted" boards and the new ones lies in the use of thermosetting resins for bonding.)

European mills, spurred by comparatively meager timber resources, produced a successful resin-bonded board in 1947. Last year the U. S. Plywood Corporation announced plans to build a plant that would make a board of this type (PS, June '50, p. 205). Meanwhile, other U. S. firms, notably the Souhegan Mills, at Wilton, N. H., jumped into the market and are now turning out millions of board feet a year.

Souhegan's main product at present is Plaswood, a ⅝-inch board used as a base for linoleum or floor tile. It is about as hard as maple, almost as strong as plywood and much cheaper—and builders are using it at a rate that keeps the mill on three shifts. Raw material consists of the rough, irregular scraps that are trimmed off when sawmill slabs are squared up. Chewed up by a chipper and a grinder, the wood particles that result are almost entirely usable. (A small fraction that isn't fires boilers to heat the presses.) Depending on price, the mill could equally well use timber straight from the wood lot, or old sawmill dust.

The manufacturing process, as the photos at Souhegan Mills on the previous page show, is essentially simple, though it requires careful control of variables. Besides the linoleum "underlayment," other products in the works include core stock for furniture veneers, special pressed and extruded forms, and a new sheathing board for construction purposes.

Future products may not be restricted to flat, plywood-like boards. It may even be possible to manufacture structural members that will replace familiar two-by-threes and two-by-fours. Here the problem will be to get beam strength to match or excel natural wood, something that can't be done on conventional molding equipment. But with special presses to apply lateral as well as lengthwise pressure, structural beams almost as sturdy as metal ones may be a commonplace in coming years.

Meantime, it's the sheathing board now being made that has R. A. Caughey, Souhegan's research director, particularly excited. It makes a building far stronger, he points out, than conventional diagonal lumber sheathing. It resists nail-hole enlargement from wind stress far better than insulating or gypsum board. It allows siding or shingles to be nailed on at random without special nails. It makes a house more fire resistant, because the resin-bonded wood burns unwillingly. And all this, Caughey emphasizes, can be had from a waste-product board that cuts costs, saves labor, and lessens timber-lot depletion. END

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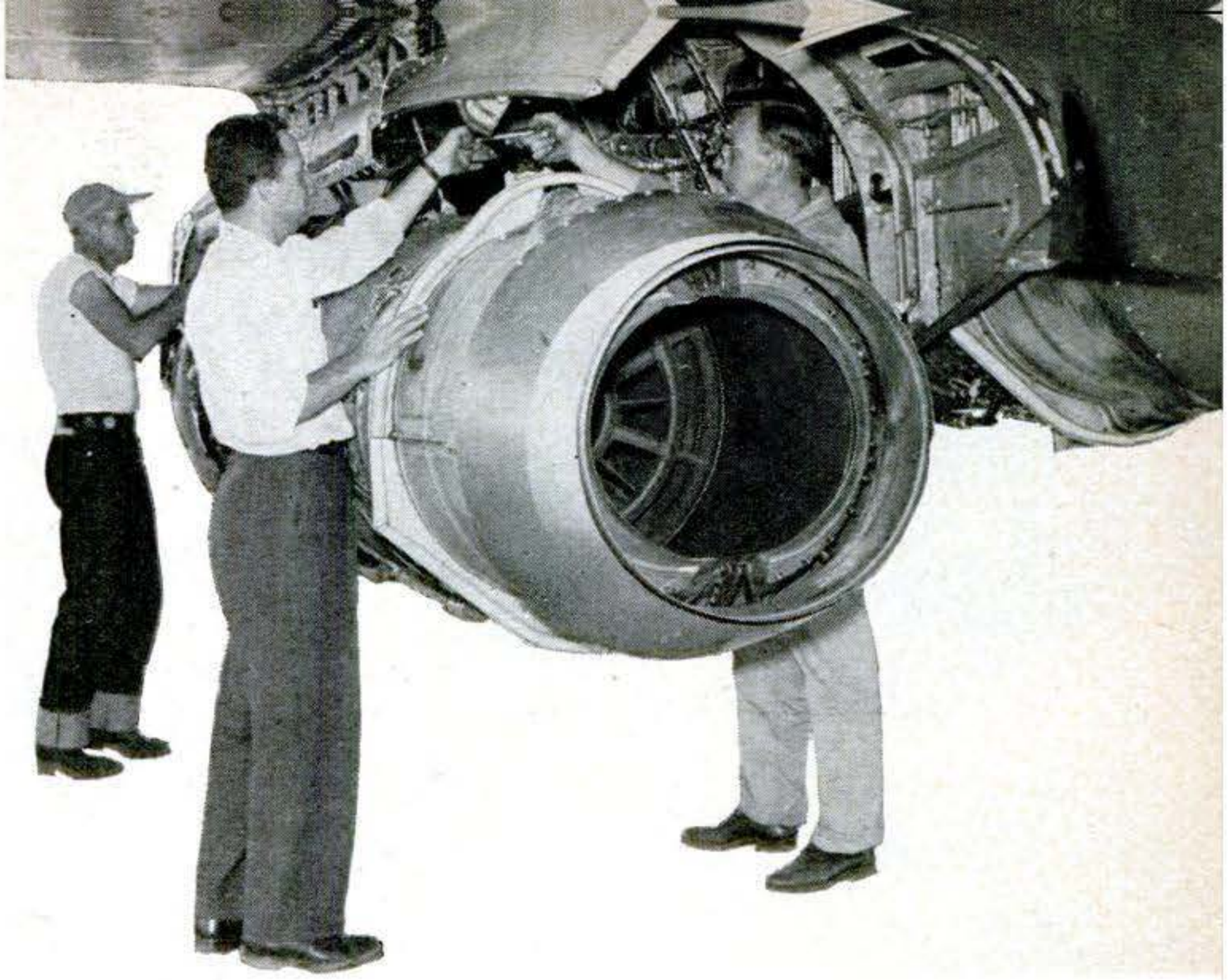
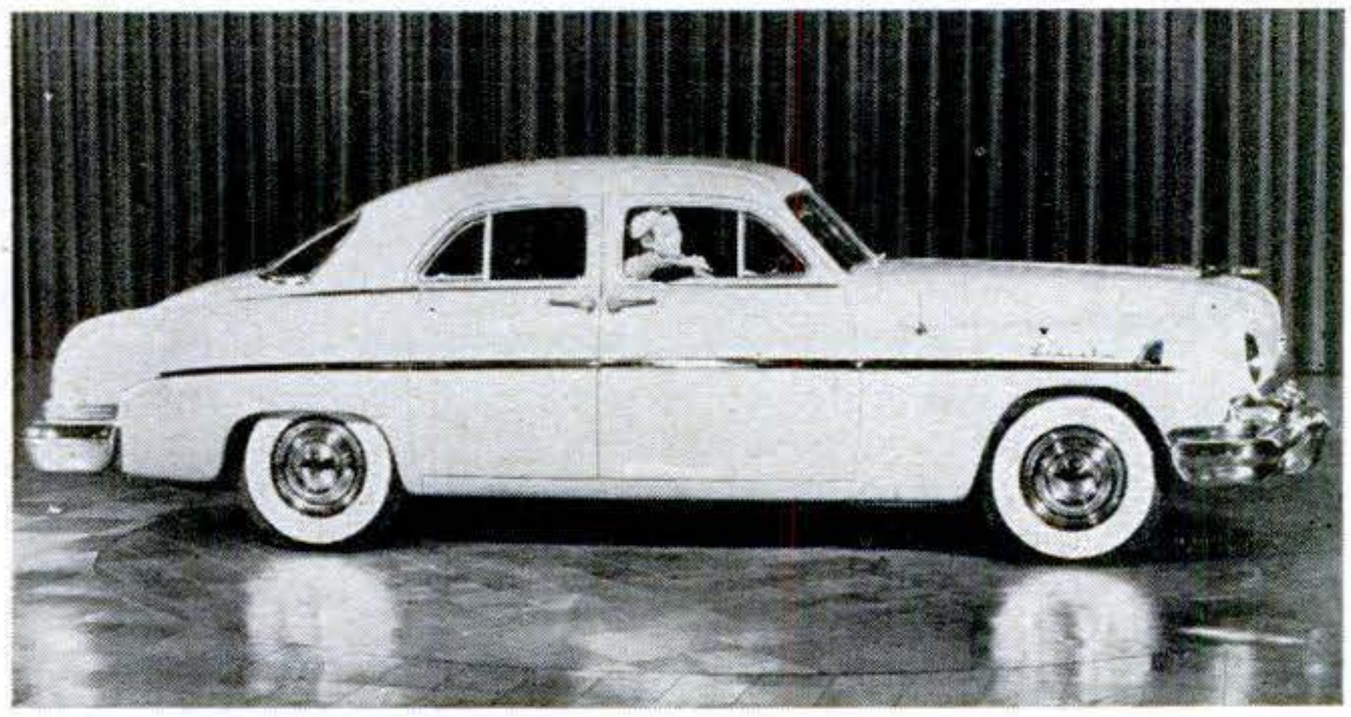
Jet Engines Swing Down for Repairs

To SAVE precious repair time on the ground, Northrop now installs the jet engines on the Air Force's F-89 fighter planes on swing-out mountings. Maintenance men need only remove the cowling and pull the power units down and outward to a convenient waist-high position, (right). It's not even necessary to disconnect controls, electric wiring, or oil lines. When the repairs are finished, mechanics operate a built-in hydraulic pump that lifts the engine back up.



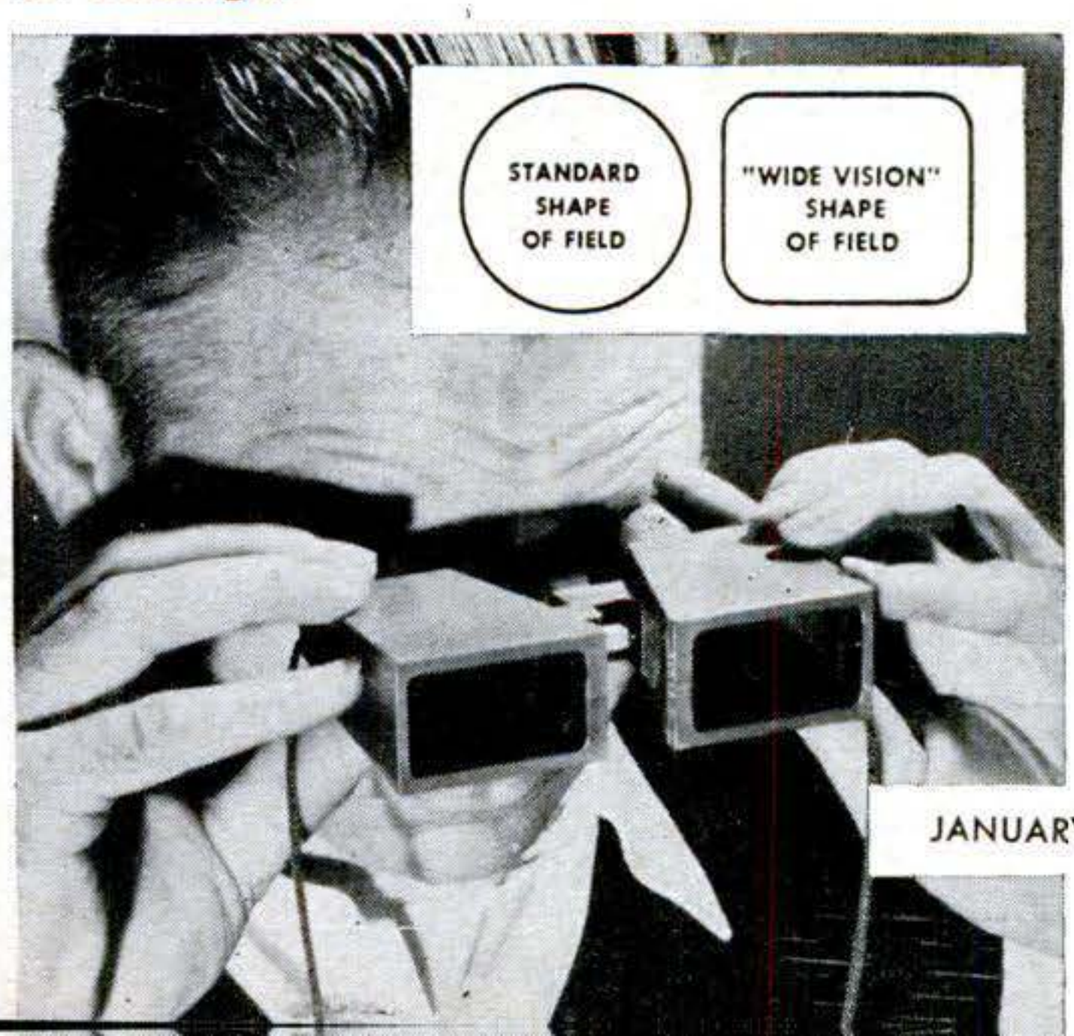
New Lincolns for '51 Look Longer and Live Longer



WITHOUT changing length, the Lincoln and Lincoln Cosmopolitan for 1951 have been made to look longer. This is achieved by extending the lines of the rear fenders. Both cars have slightly boosted horsepower—from 152 to 154. Closer bearing fits on crankshafts and con rods reduce engine noise. Alloy-iron blocks increase engine life.

Binoculars Give Wide View

SETTING a new style in binoculars, this rectangular-lens sport glass replaces the usual circular view with an oblong one (inset). Its wide field of vision, which conforms more nearly to that of the human eye, is said to make action on a ball field or theater stage easier to follow. The three-power glass, weighing about six ounces, is manufactured by Wide Vision Optics, Inc., of Chicago.



Moving Belt Speeds Grocery Checkout

SHOWN below in use at an Atlanta supermarket is a faster checkout counter developed by the U. S. Department of Agriculture. Built into the counter is a motor-driven belt on which the customer places her groceries. The checker rings up the price with the right hand and with the left hand places each item into the grocery bag standing in the open well. The register totals the bill and makes the correct change.

International News Photos cameraman gets set for ringside shot in opening moments of Louis-Charles fight at New York's Yankee Stadium. Land camera is fitted to back of Speed Graphic.

Quick-Print Camera Turns Pro

Once called a party camera, the print-in-a-minute Land is now paying its own way as a full-fledged professional.

By Sheldon M. Gallager

A FEW months ago a New York news photographer pushed an odd-looking camera into a boxing ring and snapped an action picture of Joe Louis taking a poke at Ezzard Charles. A minute later, he peeled a finished print from the back of the camera itself, slapped it on a wirephoto transmitter, and sent it out to newspapers all over the country. Total time: about six minutes from camera to California.

The camera that made this possible was the self-developing Polaroid Land camera that uses a special chemical process to turn out a finished print 60 seconds after you snap the shutter (PS, May '47, p. 150; Feb. '49, p. 232). Considered a novelty when it first went on sale in 1949, it is now earning its keep in a variety of jobs where speed and certainty pay the bill. A few of these uses are shown on this and the following pages.

Adding to the camera's versatility is the recent introduction of black-and-white film. Producing clearer, sharper images than the original softer-toned sepia, it also lets you control contrast better by varying developing time. Where lighting is flat with few highlights and shadows, you can increase the normal time to heighten the contrast. On the other hand, pictures that are too harsh and contrasty can be softened by cutting the time.

The earlier film left a thin layer of spent developing reagent on the face of the print that collected dust while it was wet and caused cracking when it dried. Now this sticky layer is carried away on the neg-

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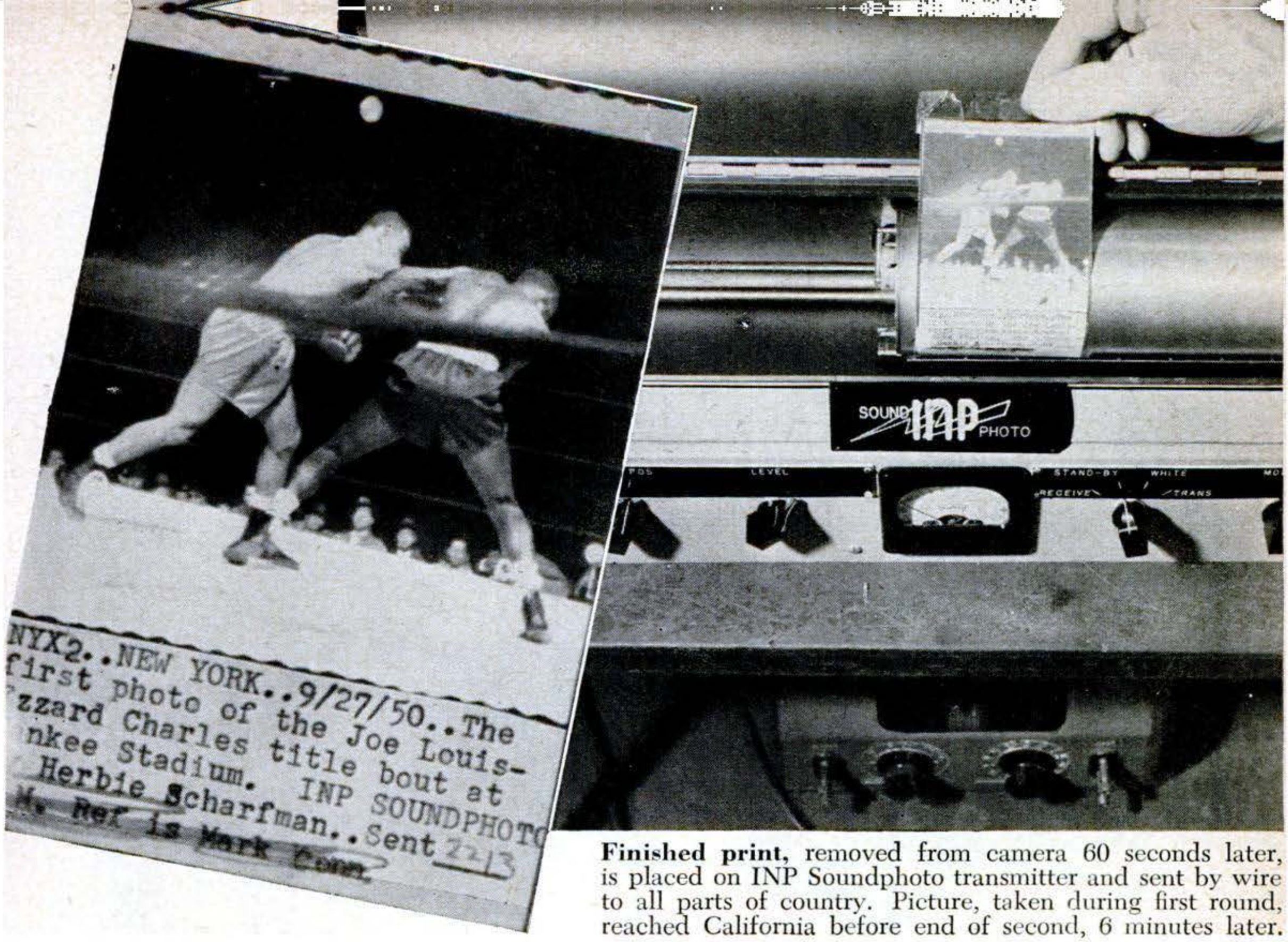
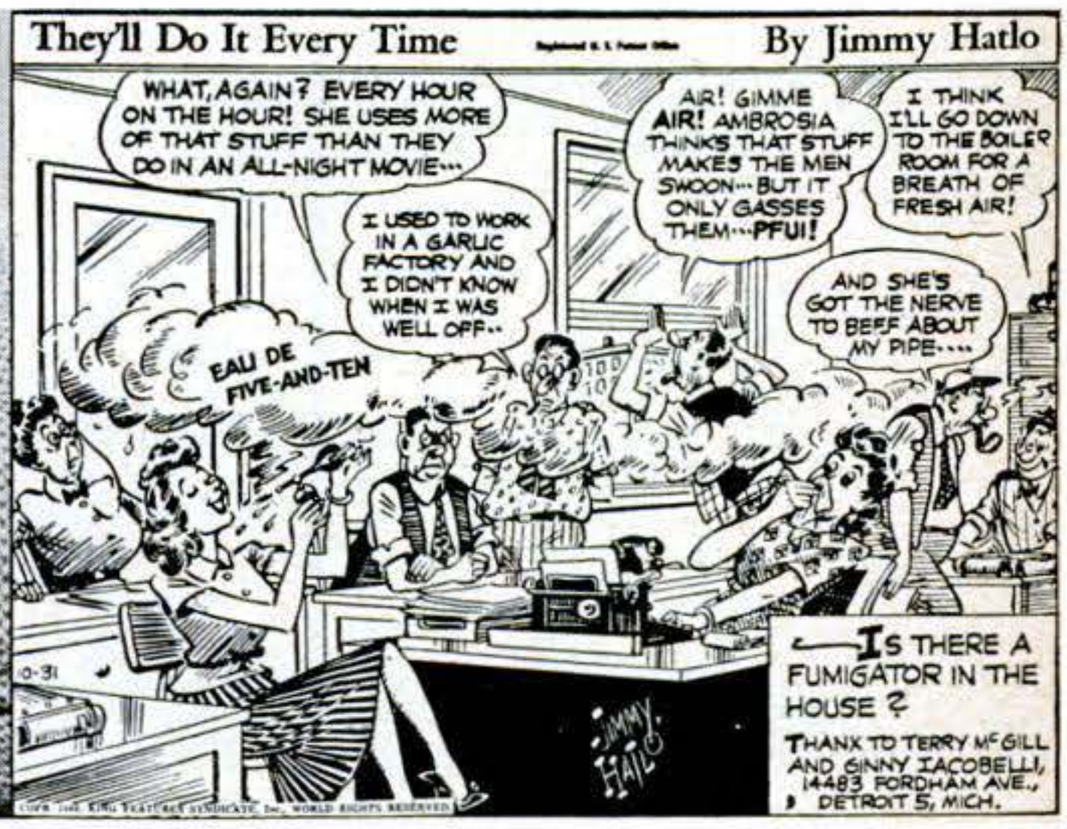


Finished print, removed from camera 60 seconds later, is placed on INP Soundphoto transmitter and sent by wire to all parts of country. Picture, taken during first round, reached California before end of second, 6 minutes later.

ative, leaving the print dry and flexible.

To simplify the camera's use, both shutter speed and lens opening are combined in a single, numbered control, providing eight settings from f/11 at 1/8 sec. to f/45 at 1/60 sec. For accuracy in determining exposure, you can get a special Polaroid-GE light meter calibrated in numbers corresponding to the camera settings. And if you flub a picture, you can tell right away and can thereby shoot it over at once.

To meet growing demands for the camera, the Polaroid Corp. is already planning new versions, some simpler and less expensive than the present $89 model, others more elaborate with high-speed shutters and faster lenses. Now available are a set of filters and close-up lenses, each mounted in its own adapter ring to speed changing, and a tape measure that shows field size



Cartoonist Jimmy Hatlo uses Polaroid Land camera to record a model's pose for famous "They'll Do It Every Time" cartoon, eliminating painstaking sketches formerly required. At right is finished cartoon, reproduced through courtesy of King Features Syndicate and Jimmy Hatlo.

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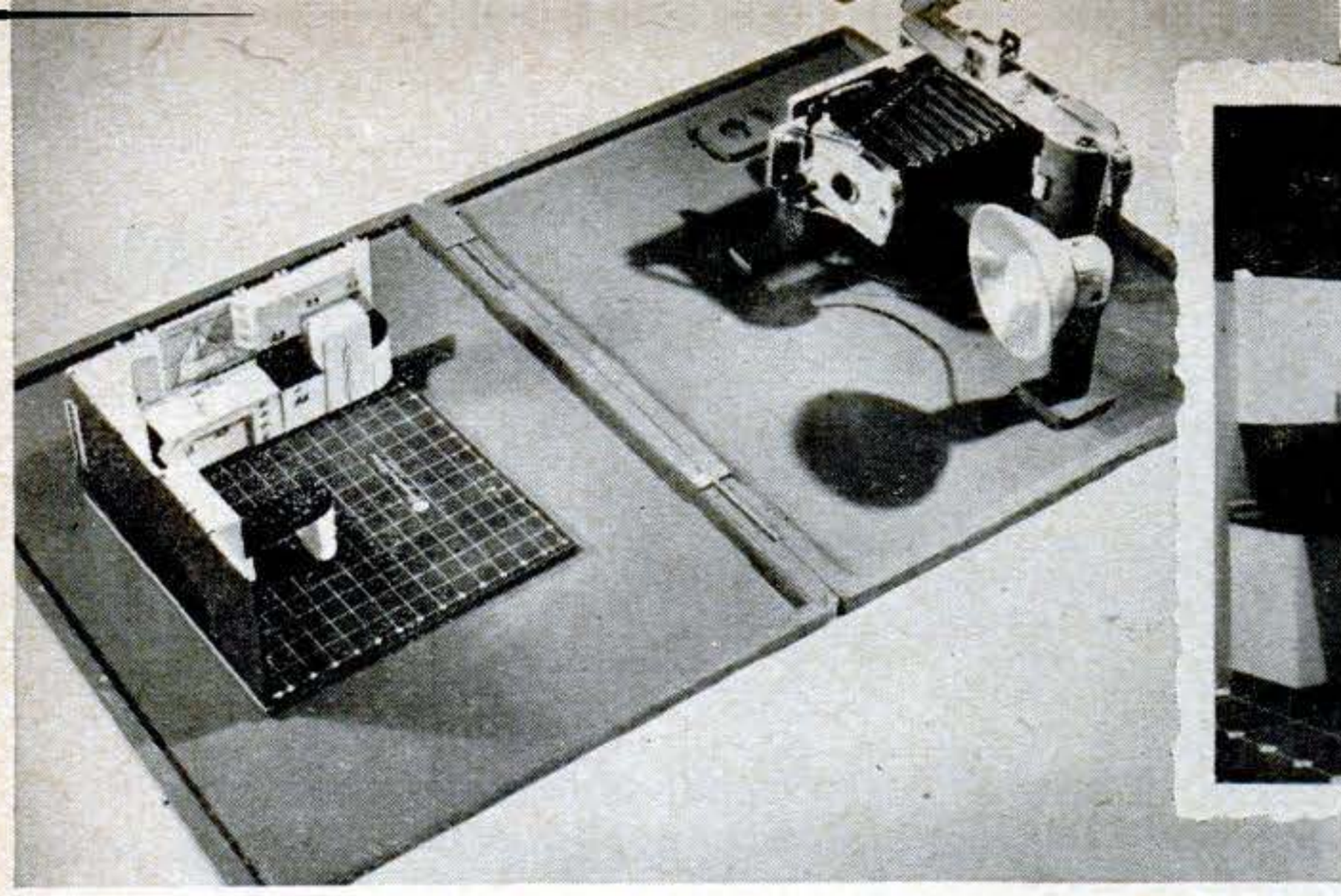
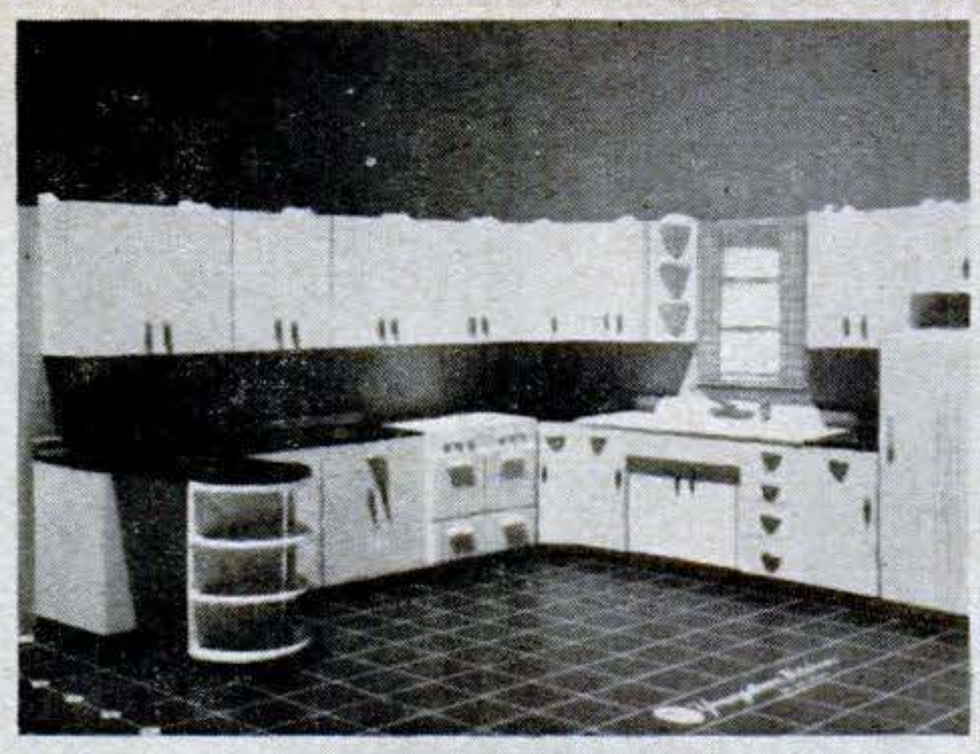
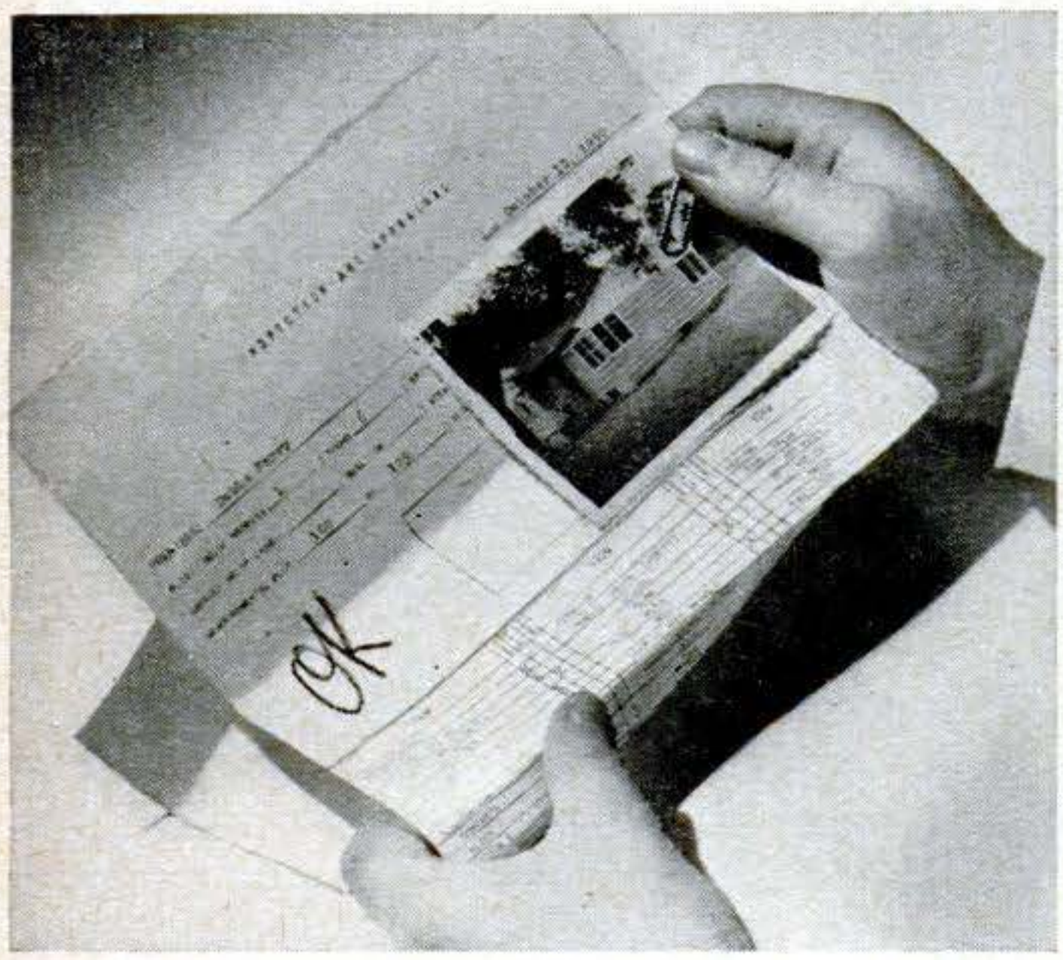


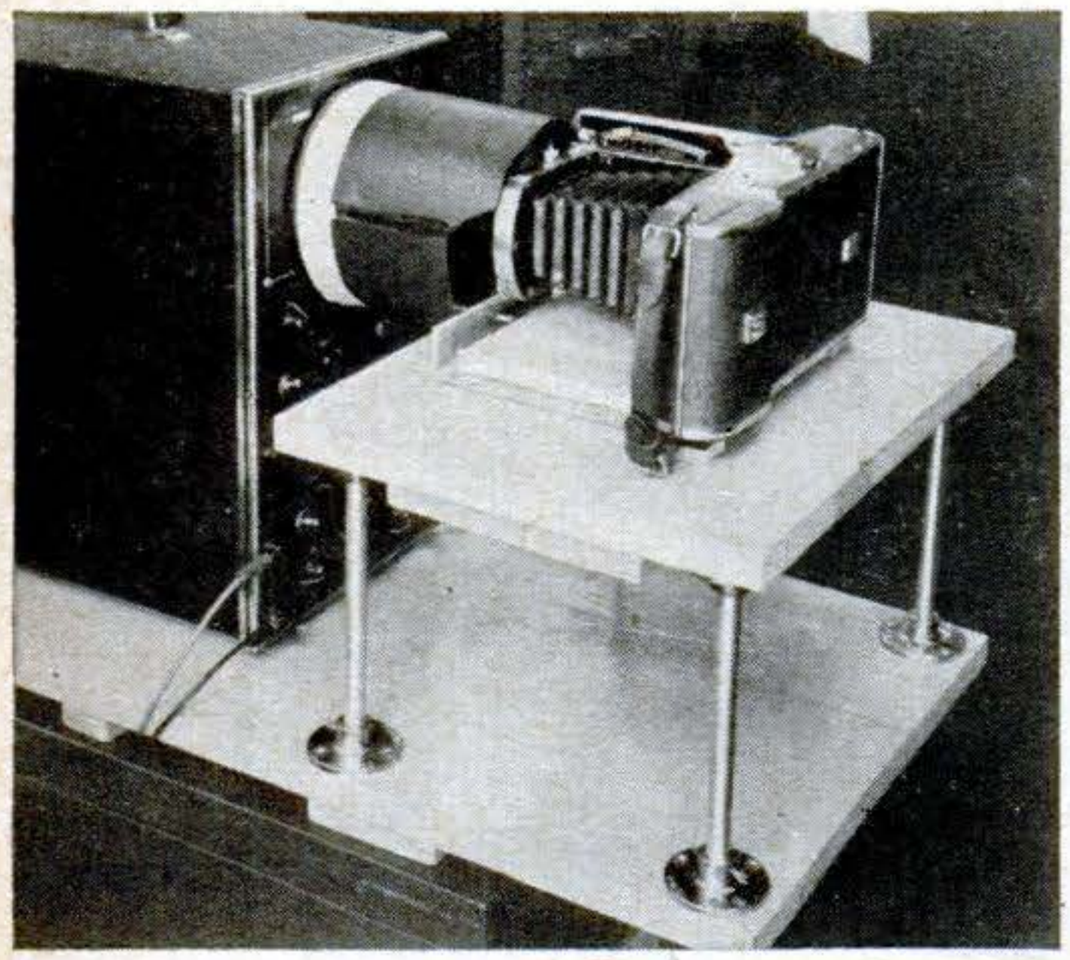


Model-kitchen setup, devised by Youngstown, lets home planners see exactly how their real kitchen will look—long before they buy. Model is first arranged to suit customer, then photographed by Land camera, and prints are given to prospective clients to take with them.



Bank appraisers use 60-second snapshots to help verify reports on mortgage applications. Real estate agents also use camera to provide house-hunting clients with on-the-spot pictures.

Freight shippers use camera to record condition of cargoes at receiving points to validate damage claims. In same way, camera is used by investigators to authenticate insurance claims.



In laboratory setup, oscilloscope readings are recorded for quick analysis by Land camera placed in front of hooded tube. Mounted on microscope, camera makes photomicrographs.

British golf pro Henry Cotten uses camera in teaching student golfers. Pictures of students in action show immediately what they are doing wrong and help them to correct mistakes.

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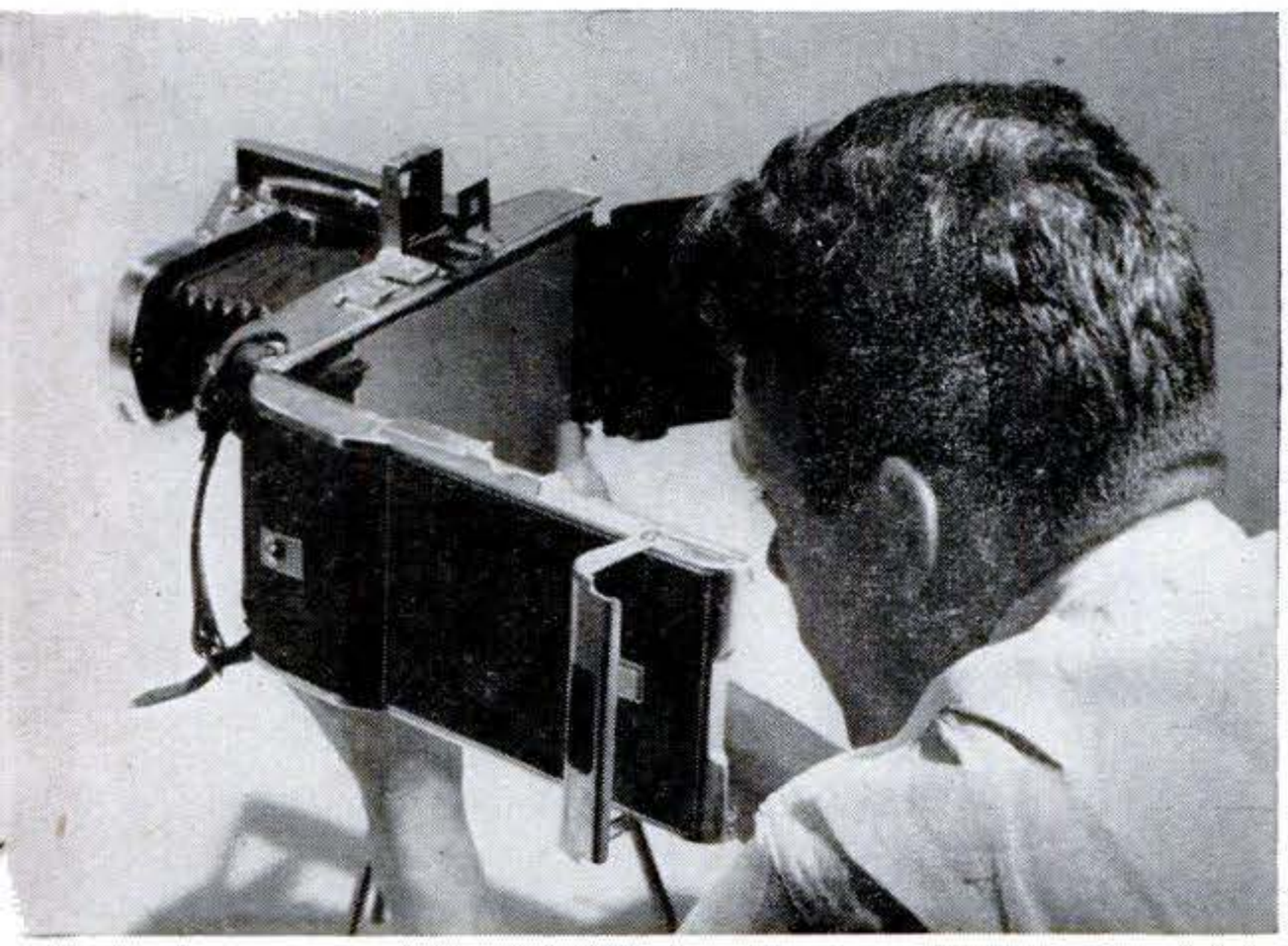
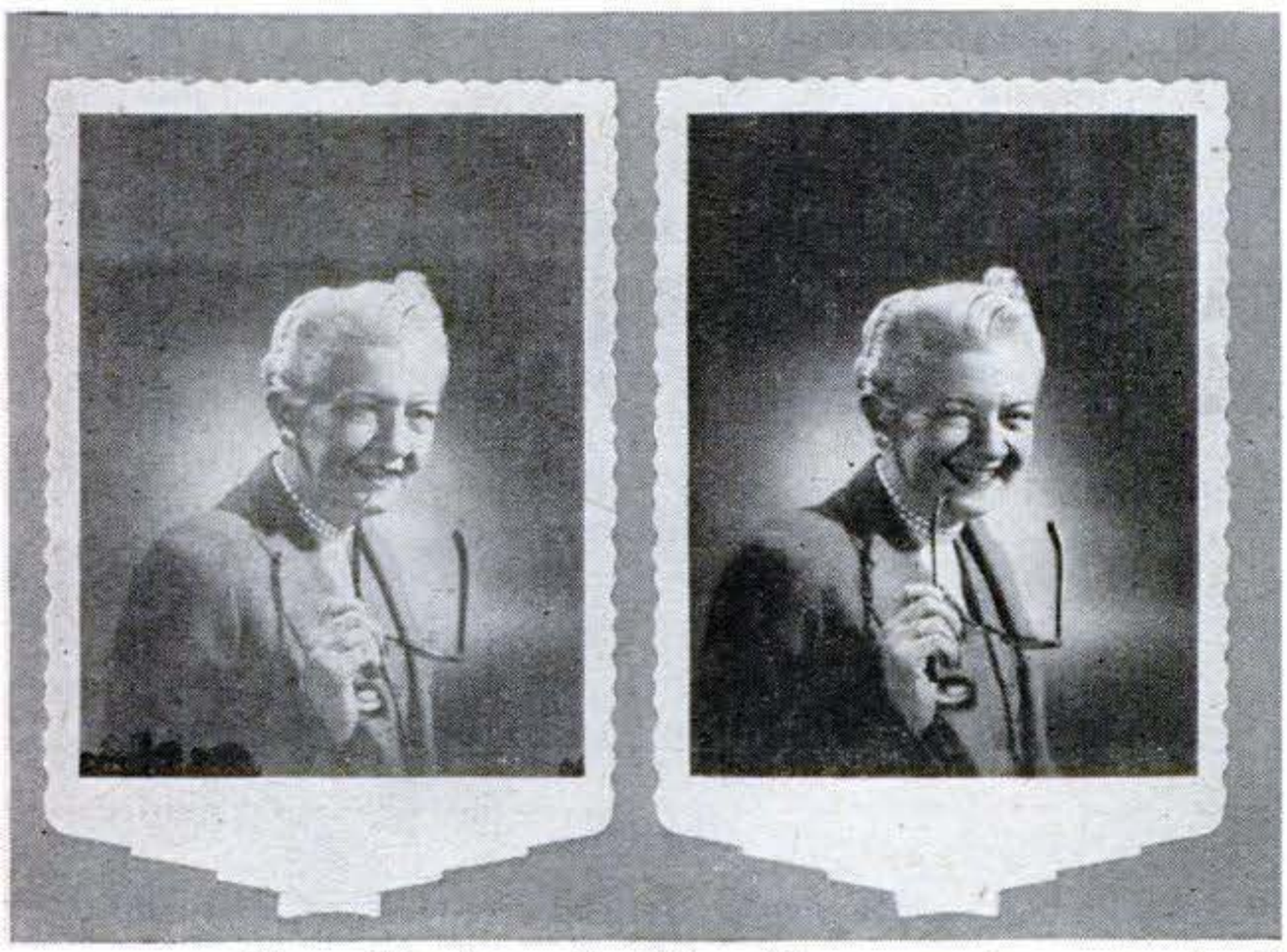
and correct focus for any camera distance.

On the battle front, the quick-print camera is certain to aid patrols photographing enemy installations. Aerial mapping crews may also use it to make sure their regular cameras have covered all the necessary area before returning home.

And in at least one instance, the versatile camera has already become a hero on the home front. Florida news photographer Pat Ford sneaked one into a Ku Klux Klan rally, caught one of its leaders with his hood down, and snapped his picture. The enraged Klansmen smashed his camera, but the picture, removed seconds earlier, was safely hidden inside his undershirt. END

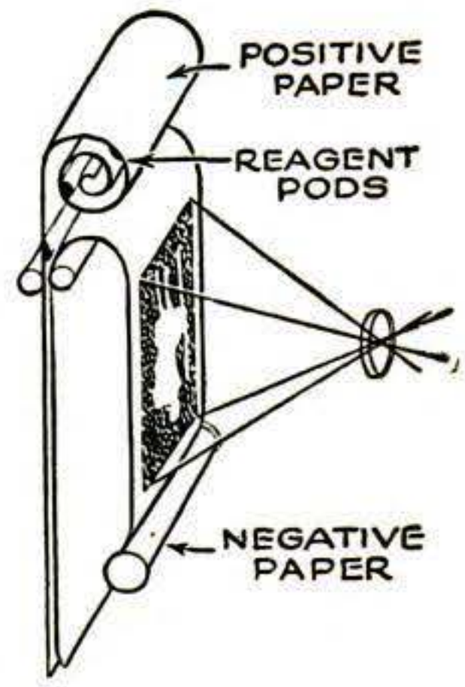


For critical focusing, image can be viewed directly on ground glass, inserted in back of camera before film is put in. A standard replacement glass for 3¼ by 4¼ plate camera will fit.

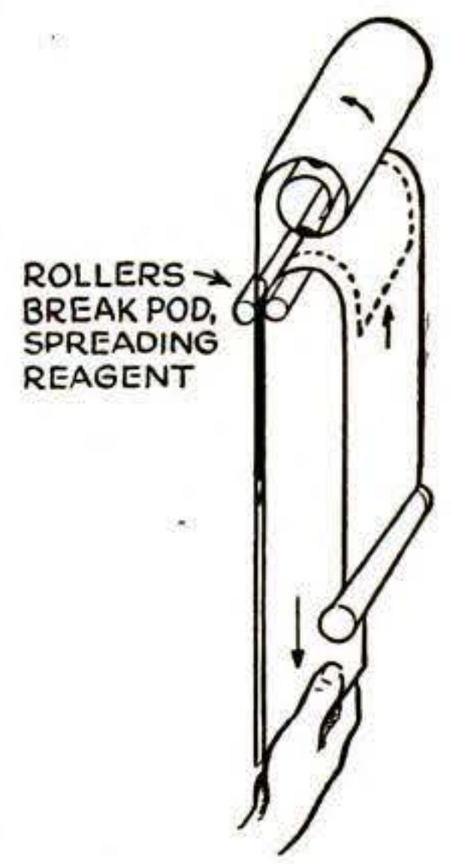


New black-and-white film permits control of contrast by varying developing time. Photos above have identical lighting, but one on right, developed longer, shows heightened contrast.

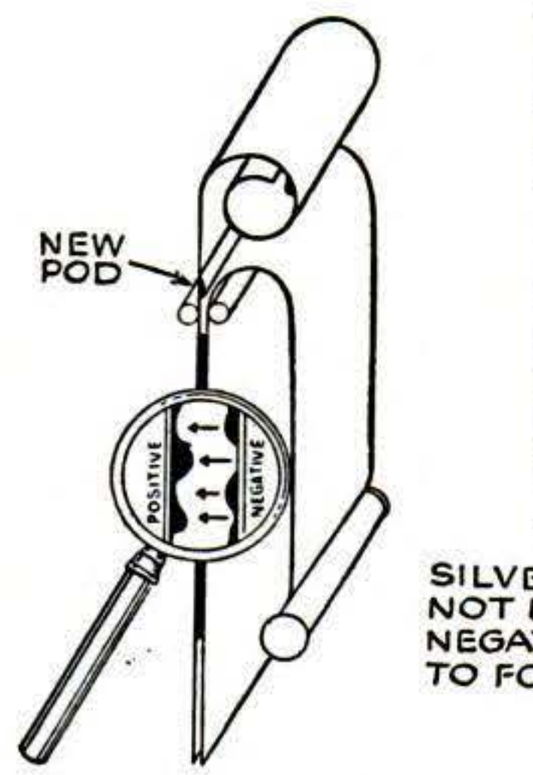
HOW LAND CAMERA WORKS



1 Special film has two rolls, one of positive paper and one of negative, connected to single leader. Attached to positive are eight pods, one for each picture, that hold jellied developing reagent. In the taking position, only negative is exposed to light.



2 After picture is taken, leader is pulled out through bottom of camera until it automatically stops. This advances both the rolls simultaneously, pulling negative around in contact with positive paper and forcing both through two rollers. Pressure of rollers breaks reagent pod, spreading developing chemicals evenly between two sheets.



SILVER NOT USED IN FORMING NEGATIVE IS DEPOSITED TO FORM POSITIVE PRINT

3 In one minute, reagent chemicals first develop negative image, then dissolve unused silver left on negative and deposit this on positive paper. Silver forms positive image, exact reverse of original negative. When image is complete, chemicals automatically stop action, and print becomes permanent. It is then peeled off negative and removed from back of camera.

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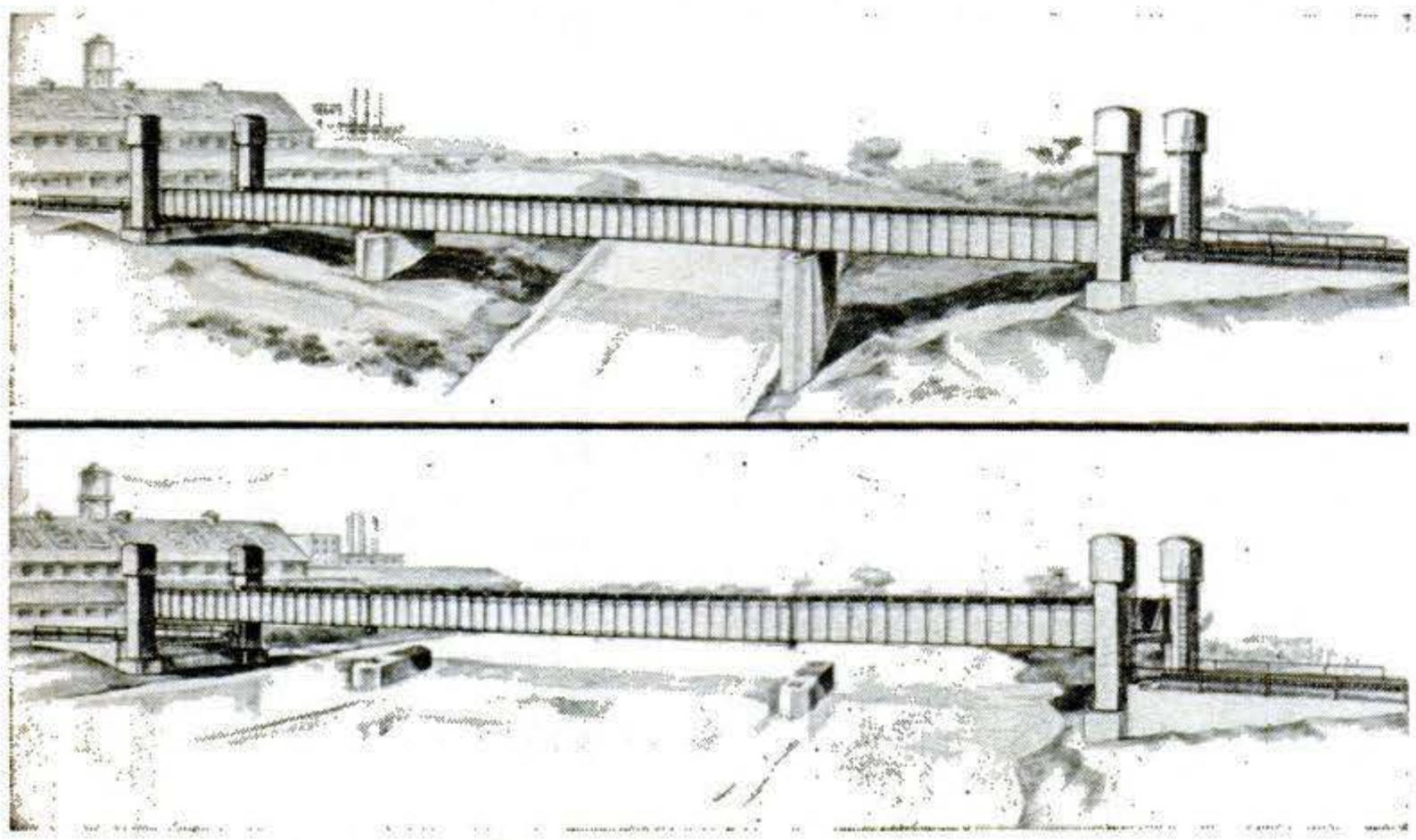
Jeep Power Plant Starts Jets

THE three-wheeled Jeep seen maneuvering easily under the wing of a Grumman fighter at right above is a self-propelled electric power plant for starting the plane's jet engine. The low-slung, 1,750-pound vehicle (inset), developed by O. E. Szekely Associates, of Philadelphia, can scoot like a cat around the limited and often plane-cluttered flight deck of a carrier. It has front-wheel drive, and steers by a single rear wheel.

Bridge Raised by Its Own Bootstraps to Foil Floods



WHEN flash floods hit the Blue River near Kansas City, Mo., next time, a 232-foot continuous-span railroad bridge will be lifted off its concrete supports to clear the raging waters. Cable-winding drum hoists in the four corner posts will raise the 320-ton bridge three feet above high-water level in 30 minutes, as shown in drawings.

Automatic Breathing Device Guards Against Lung Injury

THE artificial respirator shown being demonstrated at right automatically prevents harmful lung pressures while reviving a victim of asphyxiation. A two-valve unit regulates intake of oxygen and stops it when the patient exhales. Called a Pneolator, it is made by the Mine Safety Appliances Co., Pittsburgh.

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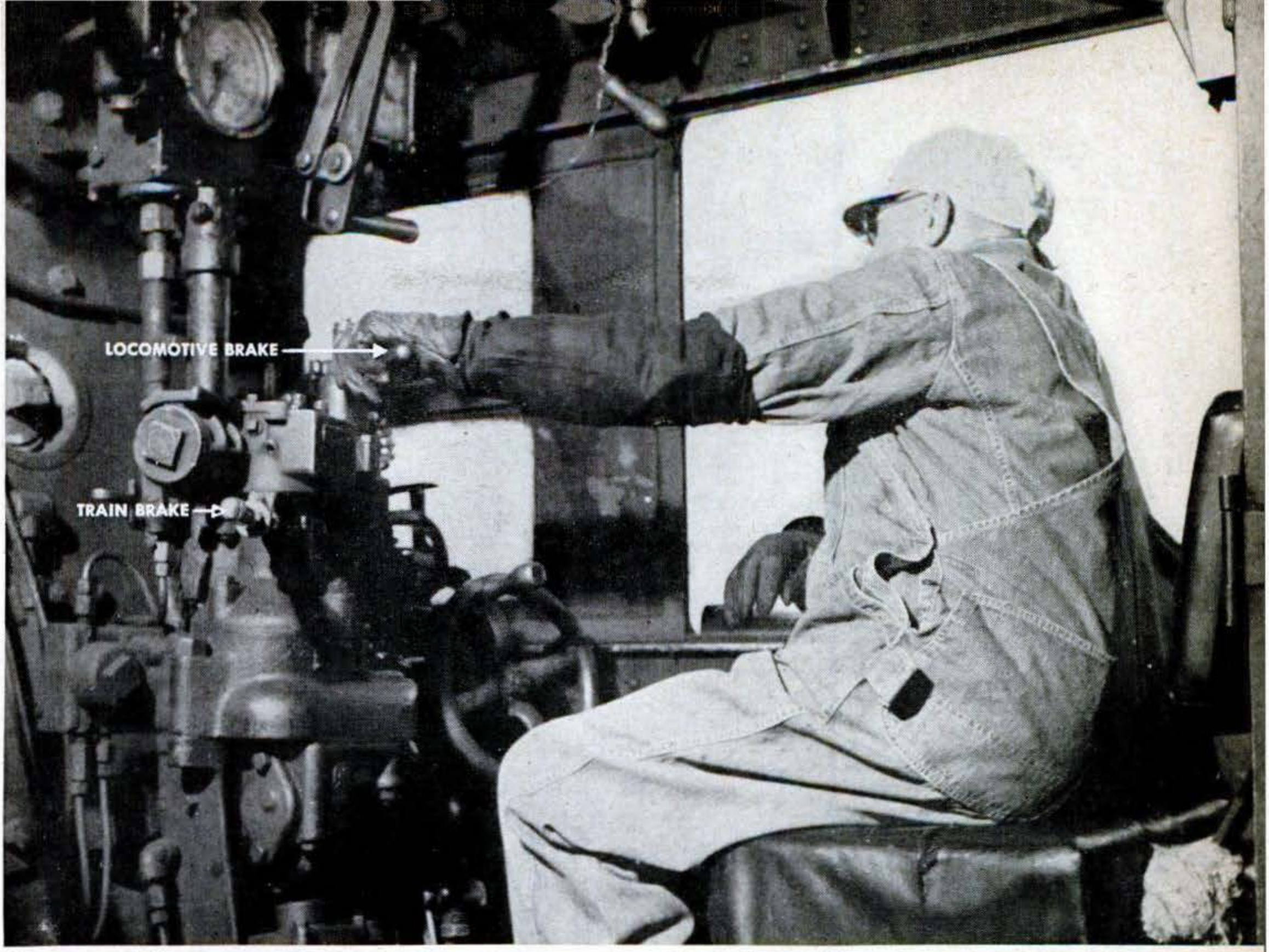
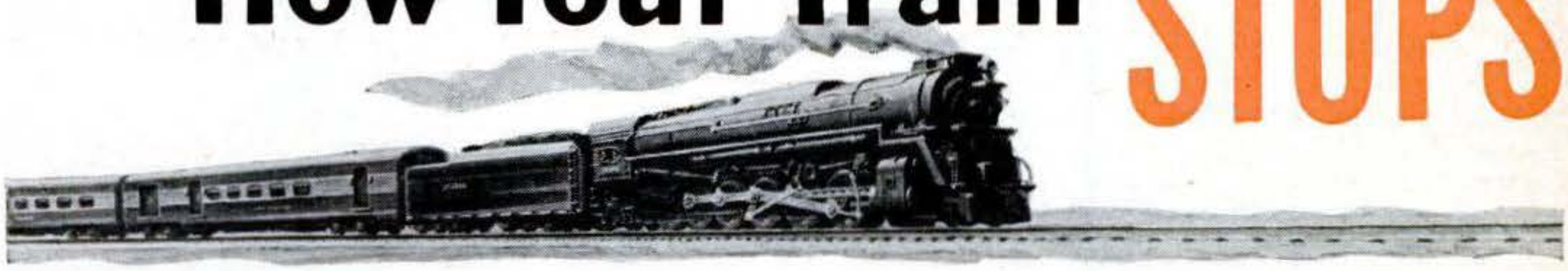


A move of the locomotive brake lever brings a New York Central iron horse to a smooth stop.

How Your Train STOPS



Combining giant strength with a delicate touch, air brakes can weigh loads, figure speeds, detect and halt skids.

By Bill Reiche

DRAWINGS BY RAY PIOCH

WHEN your newspaper headline screams "77 Dead as Express Plows into Stalled Train," you can be pretty sure that it wasn't failure of the brakes to stop the train that did it. In 35 *billion* passenger miles on U. S. railroads in 1949, not one passenger was killed as a result of defective brakes.

This admirable situation stems from an idea conceived by the great George Westinghouse 82 years ago. Up to that time trains were stopped by having brakemen rush from car to car setting handbrakes. This was so ineffective that trains did well to stop in the right town, much less at the station. Westinghouse read that compressed air was piped 3,000 feet to drill a tunnel in Italy and figured that it could be run the length of a train to apply brakes. It could be and he did.

But there's more to modern air brakes than substituting for a scurrying brakeman. There has to be, because bringing a long express to a fast, smooth stop is vastly different from reining in your sedan at a red light. Modern train brakes weigh the loads in each car to choose best braking pressures; adapt themselves to varying car speeds; and combine the brute strength needed to deliver millions of pounds of pressure with the delicacy needed to prevent a single wheel from

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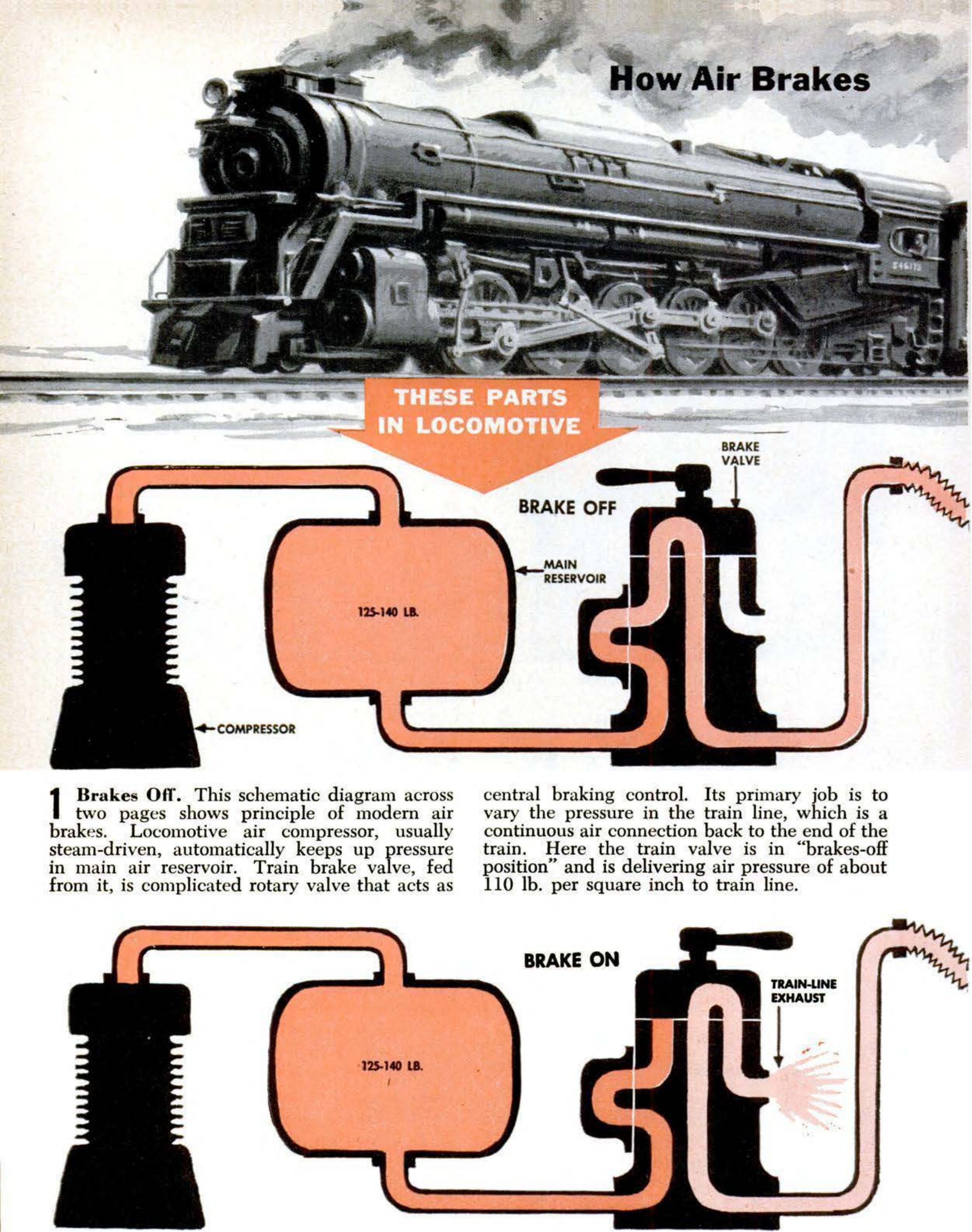
How Air Brakes



1 Brakes Off. This schematic diagram across two pages shows principle of modern air brakes. Locomotive air compressor, usually steam-driven, automatically keeps up pressure in main air reservoir. Train brake valve, fed from it, is complicated rotary valve that acts as central braking control. Its primary job is to vary the pressure in the train line, which is a continuous air connection back to the end of the train. Here the train valve is in "brakes-off position" and is delivering air pressure of about 110 lb. per square inch to train line.

3 Brakes On. To make a fast stop, engineer swings over train brake valve, cutting off air from main reservoir and blowing off pressure in the train line. The valve position shown in the diagram is known in railroad lingo as "the big hole" and is the one used for emergency stops. For more moderate application of brakes, engineer moves handle to "service position," which causes a more gradual reduction of train-line pressure. He can also move lever to "lap position," which holds line pressure at reduced level for steady, moderate braking effect.

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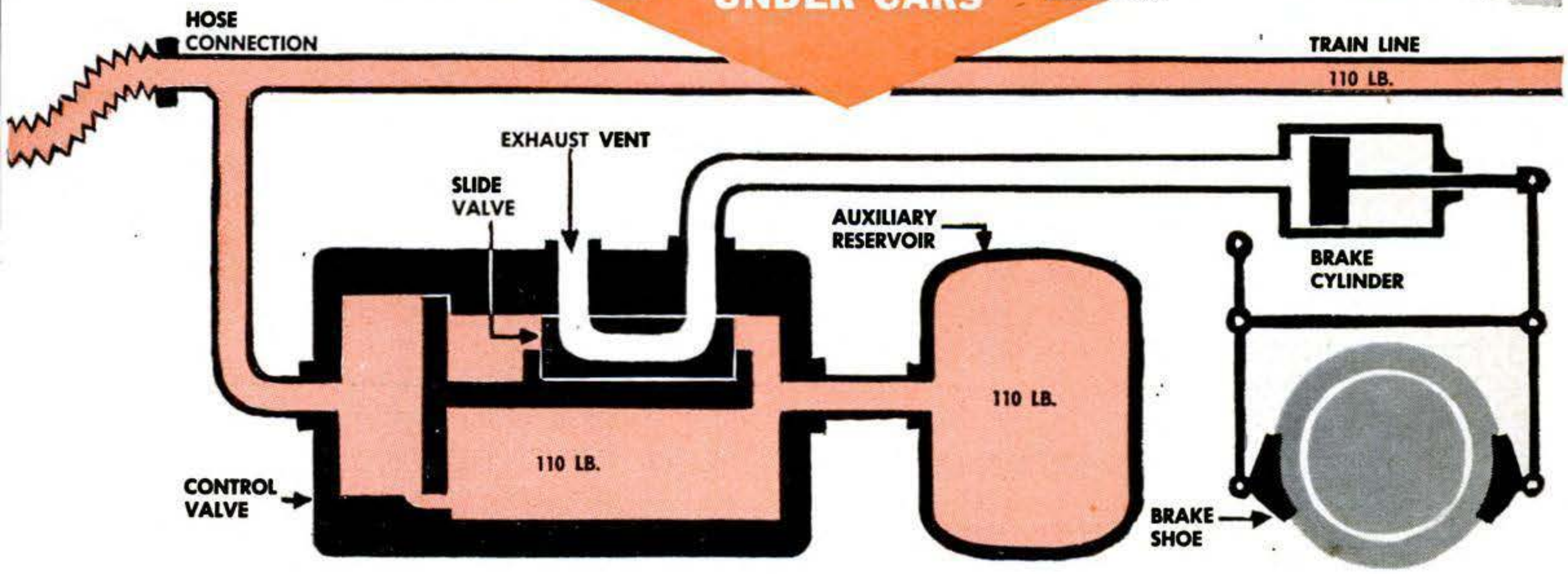
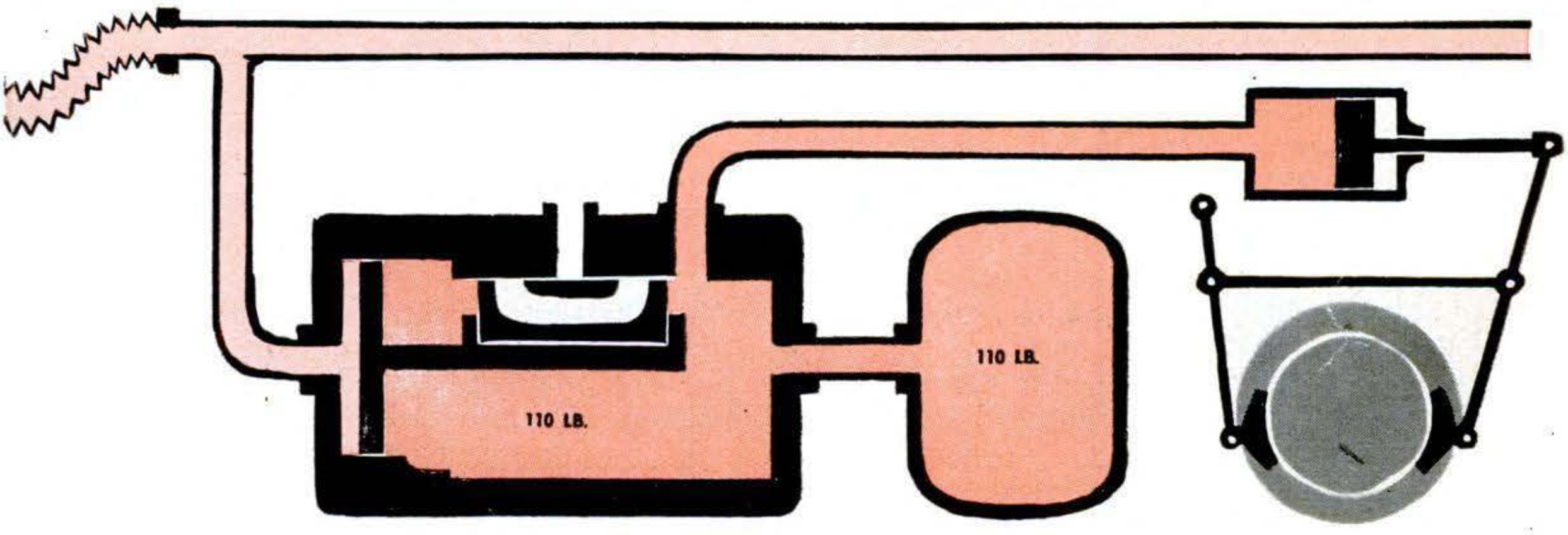
Bring an Express Train to a Halt

THESE PARTS UNDER CARS



2 Train-line air has entered the car control valve above, pressing the piston inside to the right. This opens a feed groove at bottom of piston, letting air past to charge up the auxiliary air reservoir—there's one in each car—to train-line pressure. Compressed air is excluded from line to brake cylinder, which is vented to outside air. Brake shoes do not press on wheels in this position, which is normal one when train is running under pull from the locomotive. Any slight air leakage is made up via train line from the main reservoir.



4 Falling pressure in the train line triggers brakes by means of car control valve. Lessened line pressure moves piston to left, closing feed groove and preventing loss of auxiliary-reservoir air to train line. Slide valve uncovers port leading to brake cylinder, and auxiliary-tank air moves brake piston. This operates linkage to force brake shoes against wheels. Release of brakes is reverse of this process: train-line pressure rises, control piston slides back, cutting off and venting brake cylinder. Line recharges auxiliary reservoir.

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locking and sliding along the slippery rails.

The first air brake worked in the obvious, positive way: air from the locomotive actuated brake cylinders in each car that applied brake shoes to wheels. The difficulty here was that if the train line or the train itself broke apart, air escaped and there was no braking power at all.

Within a few years Westinghouse devised a negative-action brake, the kind still used, in which locomotive air feeds reservoirs in each car and also acts as a control. With this system rupture of the line or train causes all brakes to set automatically.

How to Stop a Train

Let's see what happens in a train when the engineer moves the brake lever. Up in the locomotive there's a big air compressor and main air reservoir, a train brake valve that quarterbacks the whole team, and the locomotive's own "personal" brake system. Running back are air hoses that make up the train line. In each car there's the car control valve that takes the orders sent via the train line, an auxiliary air tank, and the brake cylinder that does the actual work of pressing shoes against wheels.

When the train is made up, air hoses are linked and the reservoir in each car is charged with air at 110 pounds per square inch in passenger trains and 70 or more in freights. In each car the control valve feeds the train-line pressure to the auxiliary reservoir, and opens the brake cylinder to outside air, releasing the brakes.

When the train is moving and the engineer moves the brake lever to service position, air from the main reservoir is cut off from the train line. Simultaneously, some train-line air is allowed to escape.

Train-Line Pressure Is the Control

Reduced train-line pressure on one side of each car control-valve piston moves it over, closing a feed groove. This bars escape of air from the auxiliary reservoir back into the train line, now at lower pressure. At the same time a slide valve attached to the piston closes the brake-cylinder vent, and feeds auxiliary-chamber air to the brake cylinder, forcing brake shoes against the wheels.

To keep the brakes on just this amount, the engineman moves his lever to lap position, which stops loss of air pressure from train line and movement of air into brake cylinders. For increased braking, he returns it to service position, line pressure falls further and more air enters the brake cylinders.

For an emergency stop the lever is thrown into emergency position, causing rapid loss of train-line pressure and a rush of all reservoir air into the brake cylinder.

Present brakes have a larger car reservoir, divided into service and emergency sections. Routine braking is as described above, but when an emergency stop is necessary, air at maximum pressure is loosed from both tanks into the brake cylinder.

This emergency air also performs an important function in hastening the release of the brakes, which is done by reversing the application procedure. Train-line pressure is raised, the control valve disconnects reservoir and cylinder, opens the brake cylinder to exhaust, and permits the train line to recharge the reservoir. The two-part reservoir speeds this process; both brake-cylinder and reservoir air temporarily discharge into the train line, the reservoir being subsequently recharged from it.

That's a bone-bare description of air brakes. Today there are some pretty fancy refinements. Brake power must be varied so that it will work equally well on a 30,000-pound empty and a 230,000-pound loaded car. This was one of the many problems solved in Wilmerding, Pa., a little town where the Westinghouse Air Brake Co. makes most U. S. railroad brakes.

Slack Snaps the Whip

If brakes do not work uniformly, slack action between cars can build up so forcibly as to damage cars and loads. Slow braking in rear cars may cause them to plow ahead and lift a car off the tracks; slow release action in rear cars may snap a train in two.

Two devices were developed to meet the problem. One ascertains whether the car is loaded or empty by means of a piston that measures the extremes of spring deflection, indicating empty or loaded condition. Braking force is automatically set accordingly.

This is all right for a coal gondola, which is either empty or full, but not for a boxcar, which might be partially loaded. A more discriminating mechanism, which measures the amount of spring deflection and sets a valve for exactly the right brake pressure, does the trick.

Subway brakes call for a similar mechanism. Here slack isn't as important, because there isn't as much of it. However, brakes must stop a subway train just as fast when it's jammed as when it's empty, since trains

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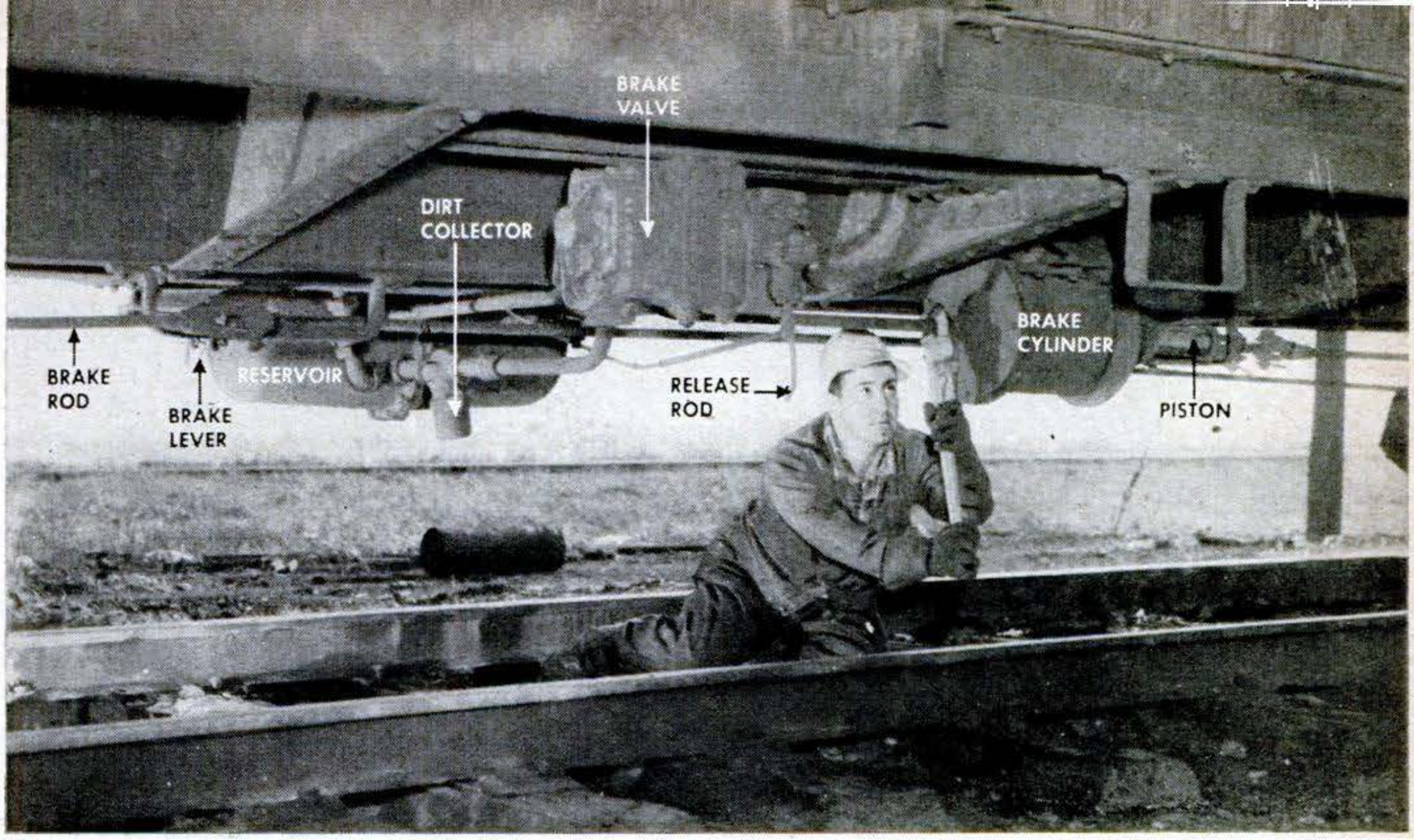

The components of an individual freight car's brake system are closely grouped and clearly shown in this "below decks" photograph. The railroad worker is tightening a connection.

fit their stations snugly and a motorman may not know the size of his load. So Westinghouse has an answer: as doors open at each stop, the passenger load is "weighed" by an automatic control that sets the right brake pressure.

Payoff in stopping a train is on pounds of brake-shoe pressure compared to car weight. At speeds below 20 m.p.h., 100 percent of the weight in pressure is okay; above 65 m.p.h., 250 percent is required. How could the brakes tell how fast the car was moving?

The answer is to make axle r.p.m.'s electrical messenger boys. Now cars on some crack trains have special DC generators driven by their axles. The axle revolutions then produce voltage in proportion to speed. Through a set of relays, which react to different voltages, the brake-cylinder pressure is maintained exactly right at all speeds.

Problem: Which Wheels Are Skidding?

If your car skids as you brake on slippery pavement, you ease up on the brake pedal, permit the wheels to turn again, and regain braking efficiency. In railroads, it's also important to minimize the locking of wheels. But the engineman doesn't know which cars are sliding—and he wouldn't want to release all brakes to unlock a few wheels.

An ingenious gadget was invented that senses when wheel deceleration is rapid enough to mean locking. Mounted on the end of each axle, it employs an inertia wheel that unseats a valve when the retardation rate is too great. This relaxes brake-shoe pressure and the wheels pick up speed. The Decelostat has contributed heavily to the silk-smooth operation of crack trains.

Changes of air pressure in a train line move at 650 m.p.h., which is fast, but it means that an engineman's "order" takes a second and a half to reach the last car of a 17-car train. So an electro-pneumatic system has been devised in which electricity carries orders at 186,000 miles a second to solenoids, in each car, that work control valves. This most precise brake system switches off a light if a circuit is broken and enables the engineman to locate the break at once. He can then switch to conventional air operation at the turn of a lever.

Westinghouse's most impressive research tool is a test rack incorporating all brake equipment for a 150-car train, with 7,500 feet of train line coiled in its 100-ft. length. It can duplicate every condition encountered in stopping a long freight train. The men of Wilmerding can make up to 12,000 brake sets a month, worry about such diverse problems as developing a 60,000-hp. braking system for a South American ore-carrying line and how to keep wasps from nesting in brake valves in Wyoming. They've also built a locomotive brake valve that whistles like 22 starving peanut vendors if the engineman takes his hand off the brake lever, and after four to six seconds sets the brake automatically. END

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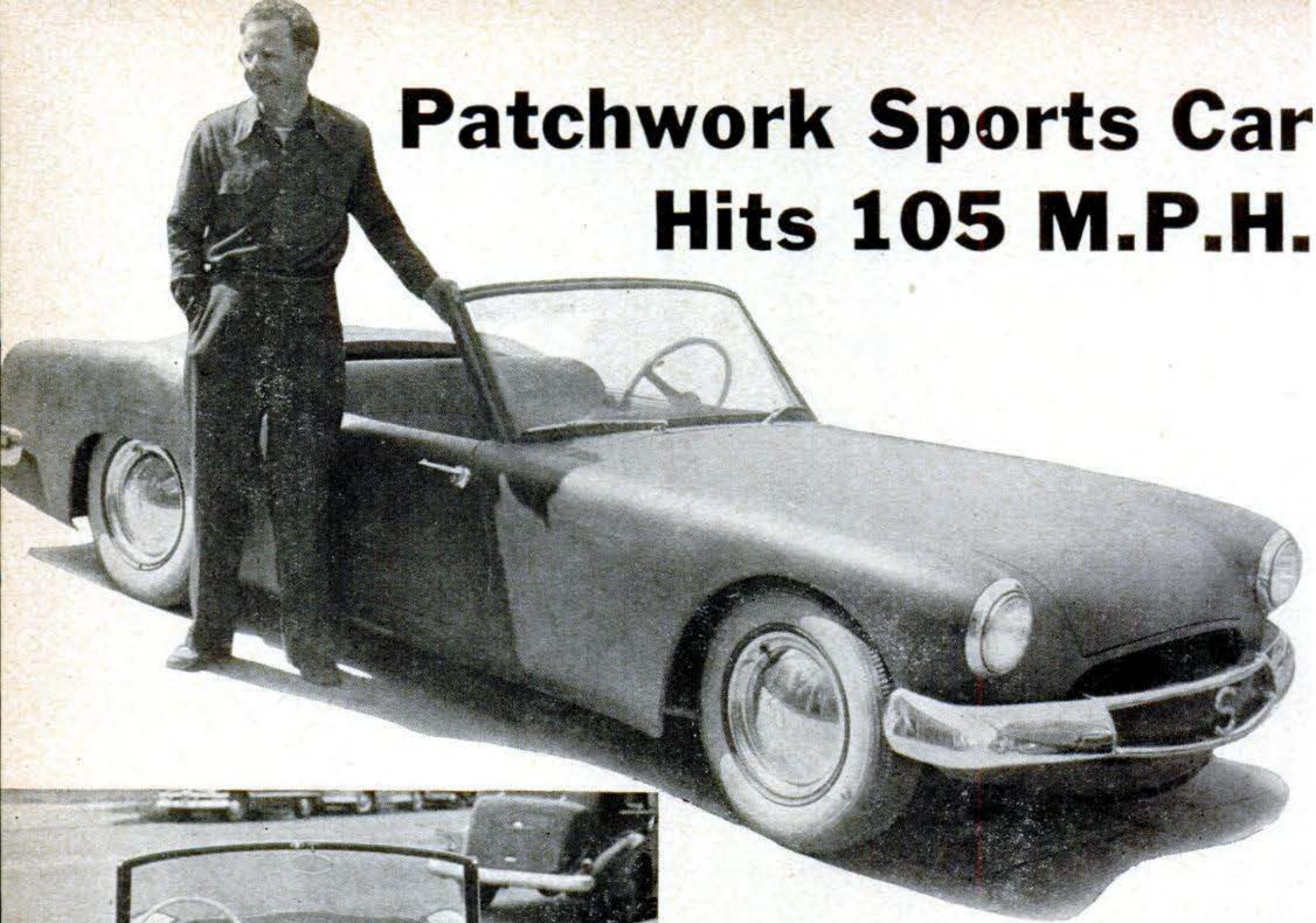
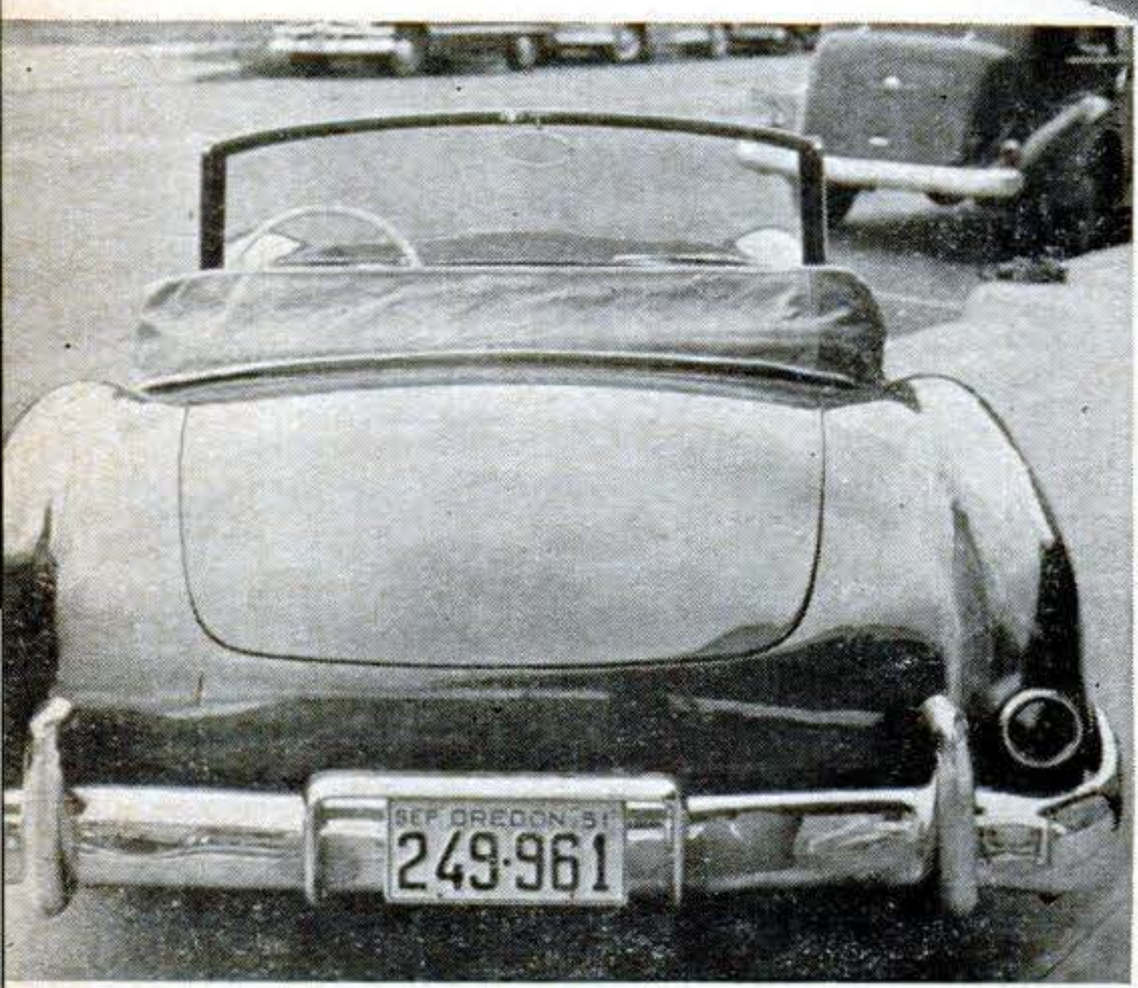
Patchwork Sports Car Hits 105 M.P.H.





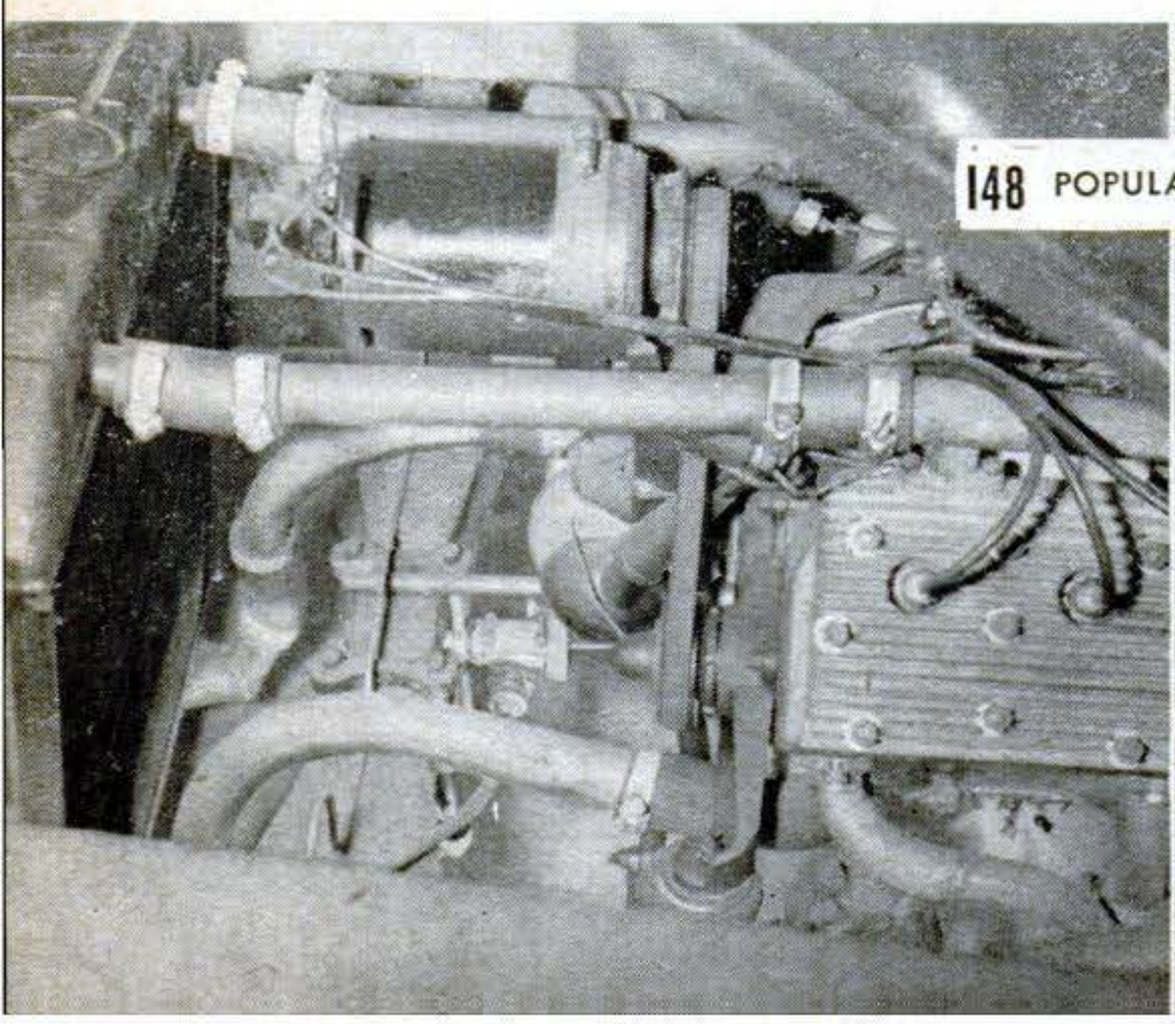
Airplane shocks aid rear springing. Trunk, hood, cowl, and doors were formed by hand from 10-gauge molybdenum steel. In top photo builder is shown alongside his auto creation.

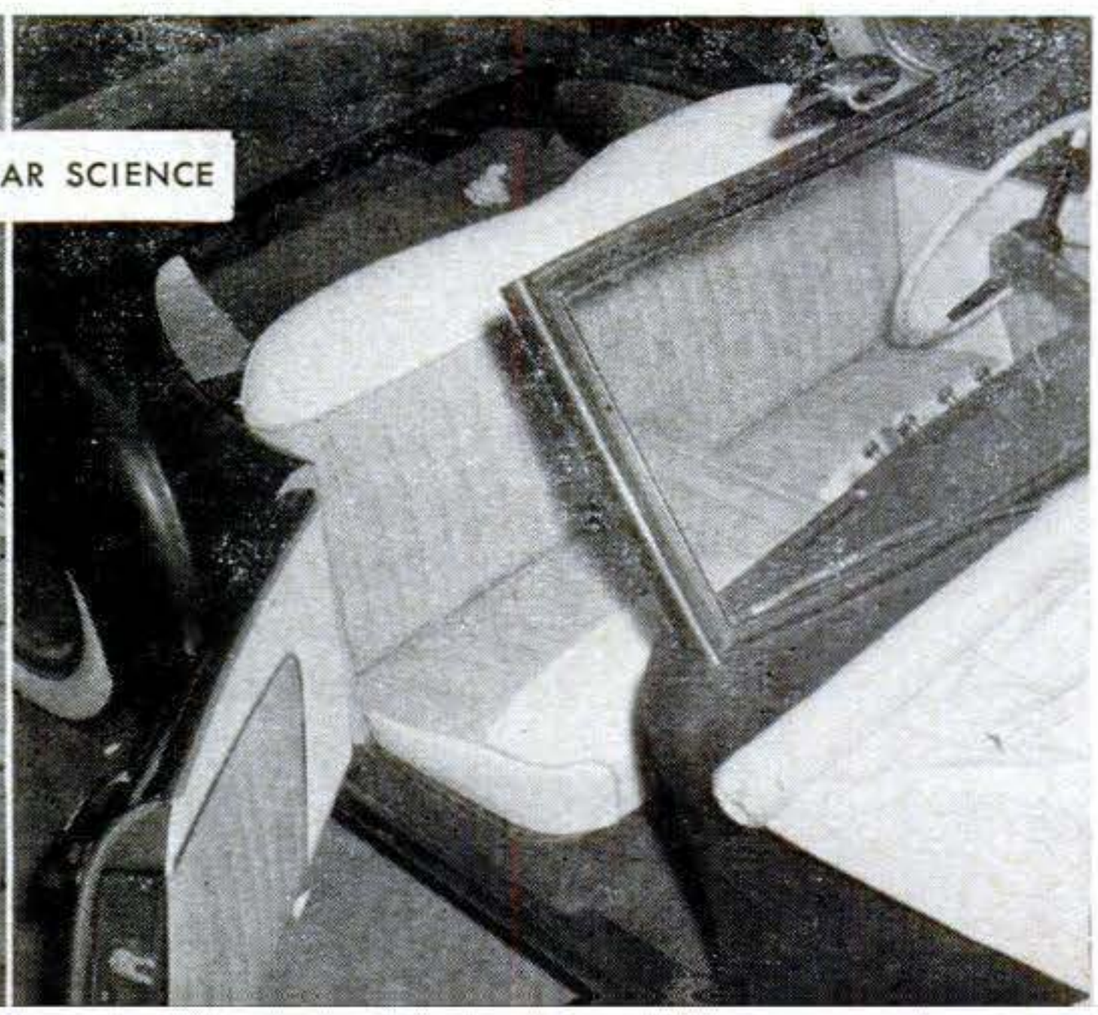
PRODUCT of a year's spare-time work, this homemade sports car was built by Tom Story, foreman of a body shop in Portland, Ore. With a wheelbase of 97 inches, the car is really low-slung: the top of its Lincoln windshield is only 46 inches above the street, though the car still clears the ground by 5 inches. Its engine is a reworked Ford V-8 "60" with twin carburetors. It now puts out 113 hp. at a compression ratio of 10½ to 1.

Story used the springs and rear axle from a Willys, a Mercury grille and steering wheel, Chevrolet front fenders, and the rear fenders from a Pontiac. The 2,080-lb. car has been clocked at 105 m.p.h.

Special heads and other modifications almost double power of Ford engine. It's mounted well back of the radiator for better balance and increased traction on rear wheels.

Floors and seats are built so low that the drive-shaft tunnel serves as an arm rest in center. Upholstery is yellow and white plastic material. Outside finish is green.





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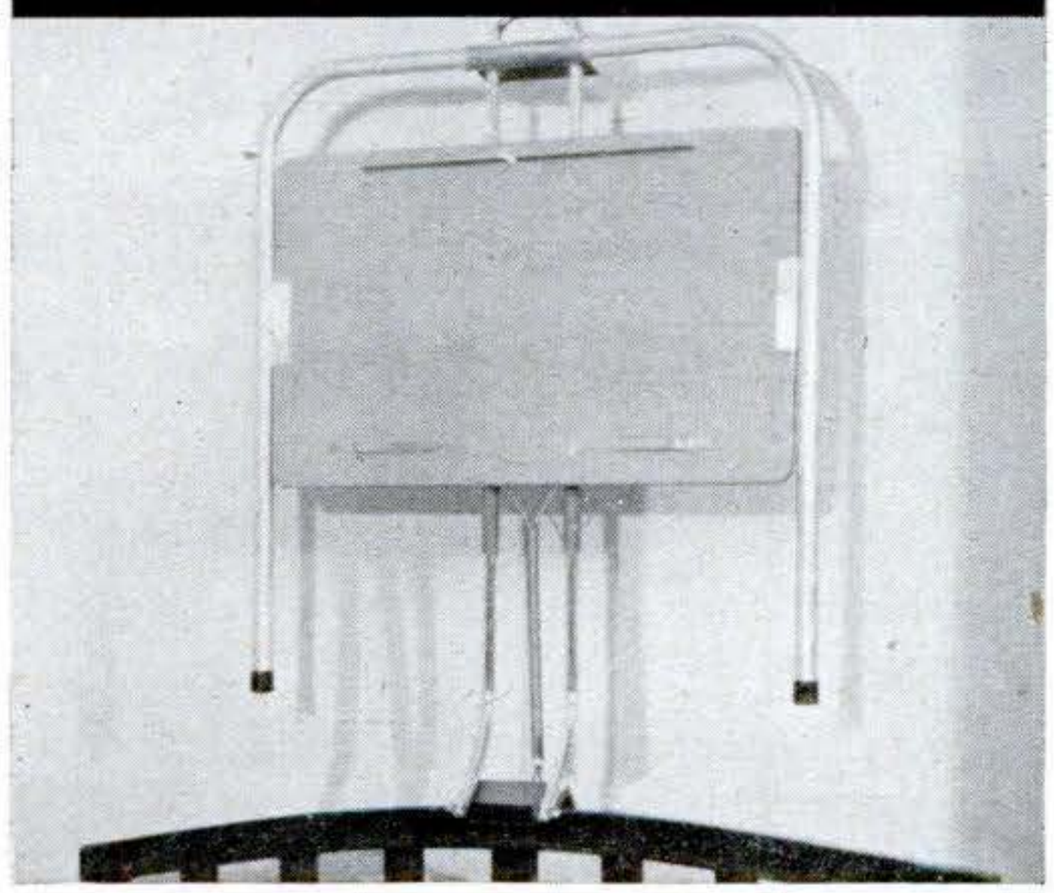


Lie-Down Patient Gets Table

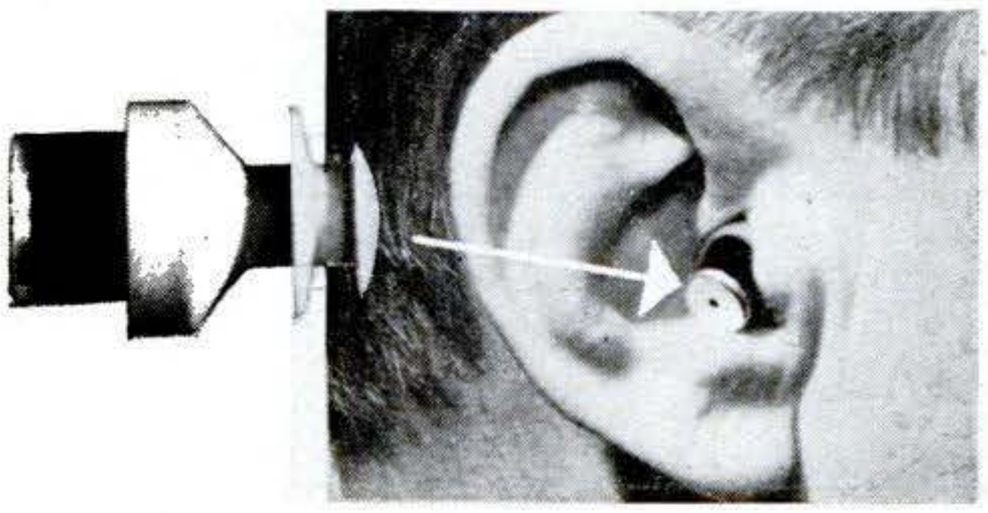
To BRING comforts within easy reach of a patient who cannot sit up, a Seattle inventor, Paul A. Carlstedt, has devised the Li-Abed Table. Attached to a bed and counterbalanced by a spring, it may be swung into place or out of the way (lower view) by the patient. A panel holds a book for reading (top view); reversed, it has a mirror for make-up or shaving, and pockets for toilet articles.

Snow Gauges Predict Run-Off

How much water will this winter's snows supply to spin turbines and irrigate ranches next spring and summer? Snow gauges, on 15-foot towers dotting California mountains, tell the story. Atop each tower an open container, holding a measured amount of salt water, collects and melts falling snow. Power-company men check the depth of liquid with a measuring stick, above, to predict the coming run-off.

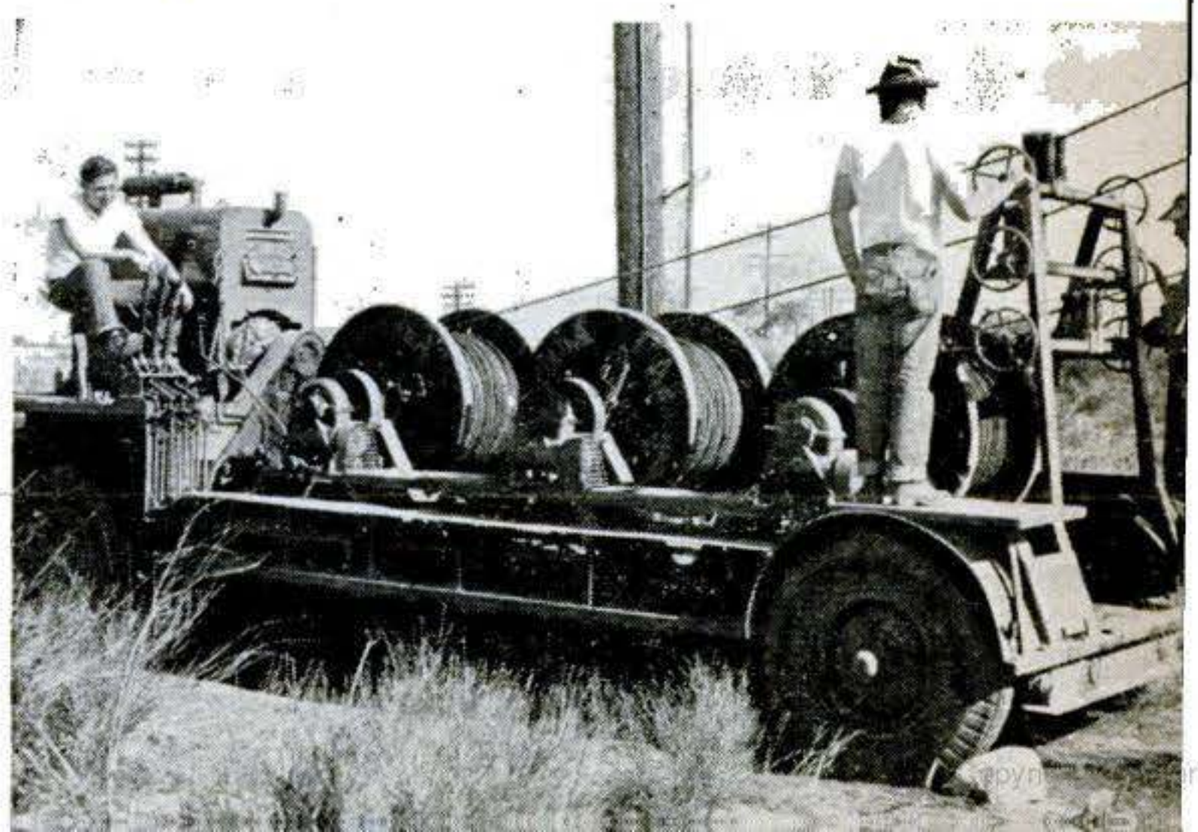
Ear Valves Strain Out Noise

WORN like ear plugs by workers and troops, "sonic filters" exclude loud noises without obstructing weaker ones. Wearers can converse in normal tones in a riveting plant or under gunfire. A sensitive quick-acting valve in an air passage closes momentarily in response to the sudden air pressure of a sharp noise, and then reopens. The precision-built device, called the Lee Ear-Valv, sells for $4.95 a pair.

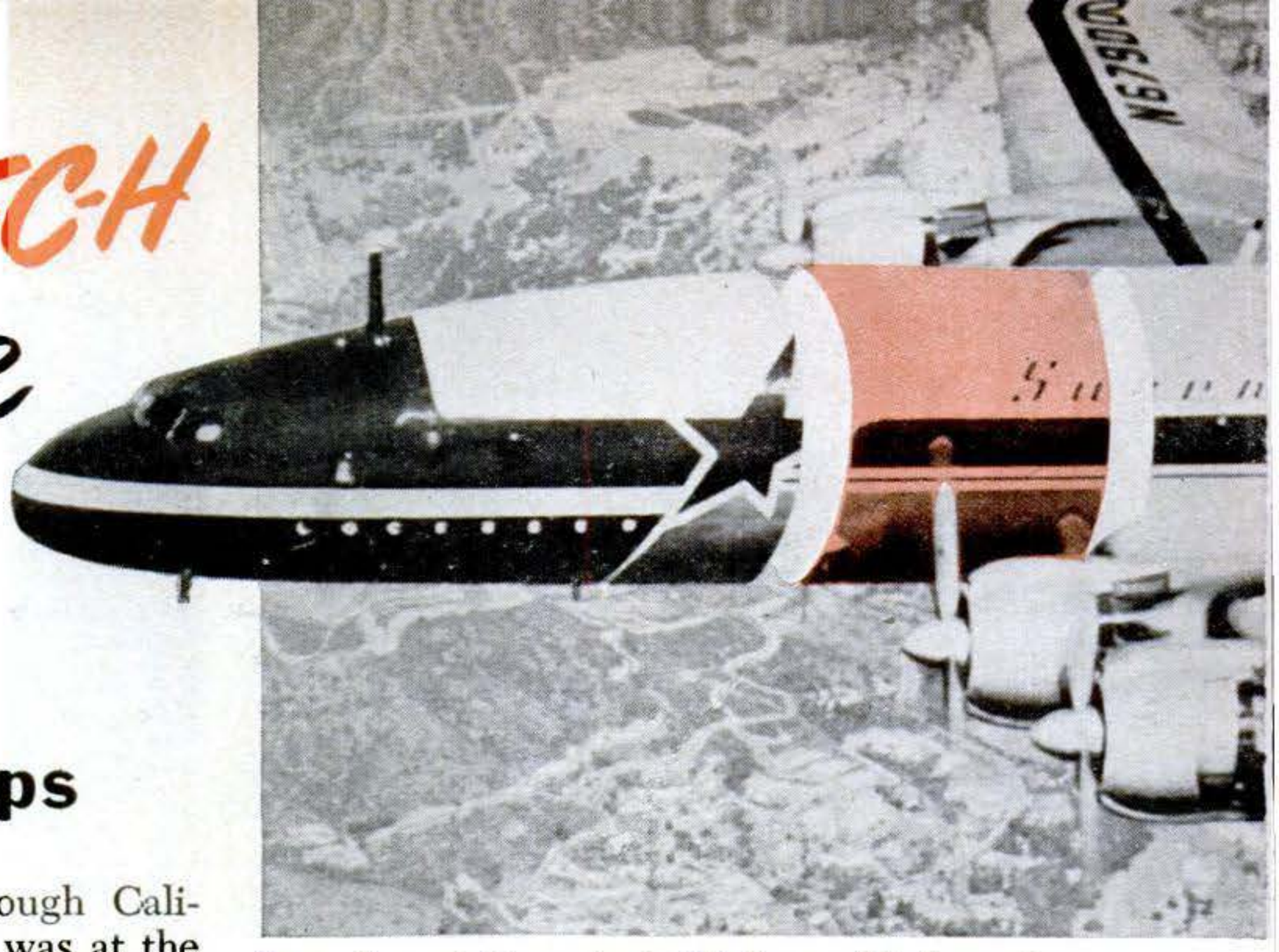


Trailer Strings Power Lines

THREE power lines slide simultaneously over crossarms when the Southern California Edison Company's triple-reel trailer, below, goes into action. Wire being strung, fed from a trailer at one end of a working section, is drawn taut by this trailer at the other end. A Chrysler industrial engine powers all three reels. Two men turn small wheels operating guides that keep cables moving evenly across drums.



HOW TO S-T-R-E-T-C-H AN AIRLINER



Lengthened liner had 10 feet added to the

Super Connie Set for Turboprops

RECENTLY there soared through California skies an air liner that was at the same time the newest to take wing and one of the oldest now flying. The triple tail clearly identified the ship as a Constellation. But something had happened to the fuselage. The passenger compartment had been stretched some 18.4 feet to produce the prototype of a new plane, the Super Constellation.

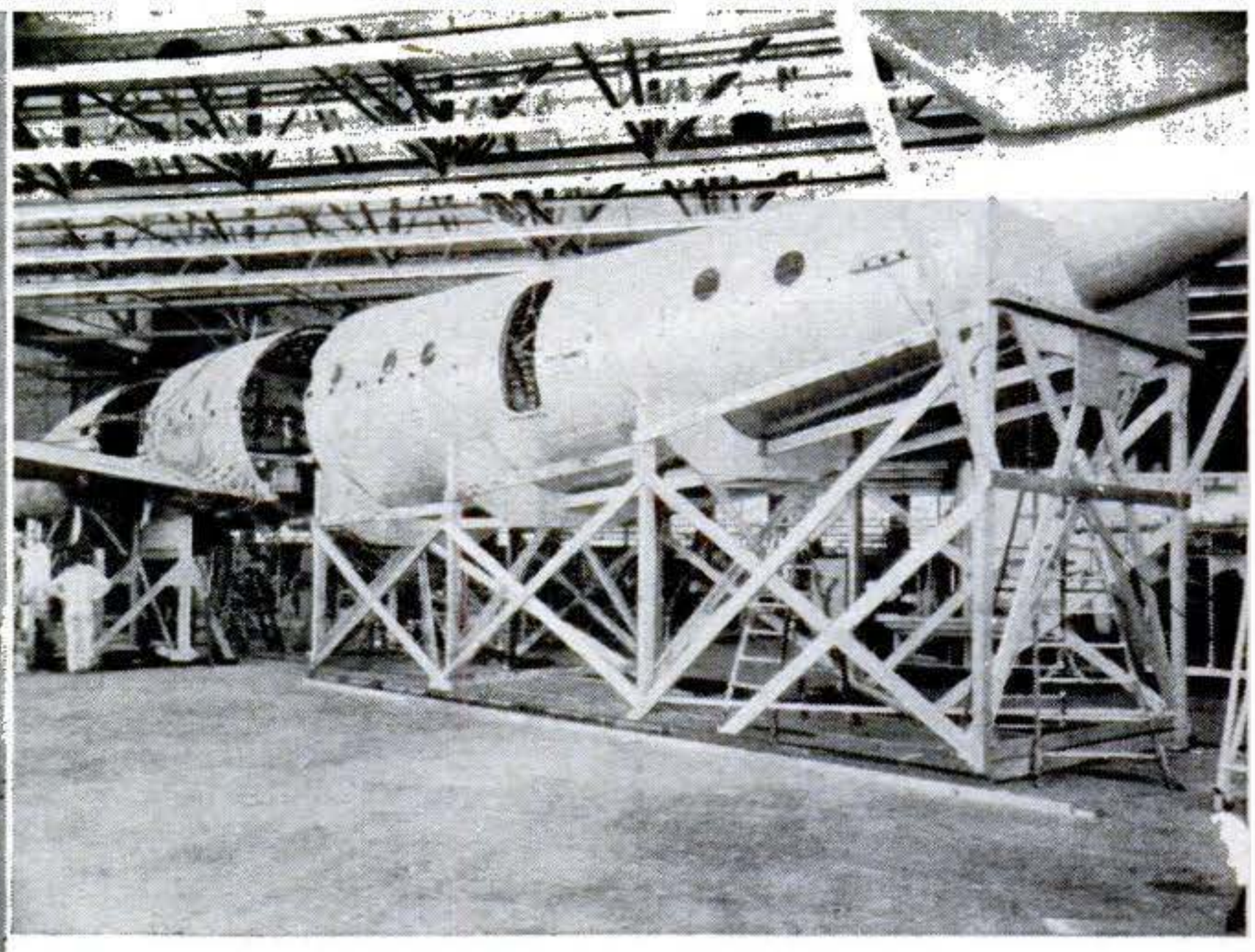
Lockheed officials had decided that they needed a plane to bridge the gap between present piston-engined transports and the all-jet jobs now on the drawing boards. Such an in-between type would meet competition on the world's airways until jet transports were actually here. And by rebuilding an existing plane instead of designing a new one, millions of dollars and at least three years' time could be saved.

After studying what this transition plane would have to do, engineers concluded that an elongated Connie might fill the bill. So they took an old ship—coincidentally, the first Constellation ever built—and went to work on it.

First they built three supporting cradles, one under the nose section, another under the wings, and a third under the tail. After removing floor beams and wiring, they took a portable electric saw and sliced the fuselage completely around in two places. One

The new Super Constellation seems to dwarf the present Connie beyond it. Yet wing span of 123 feet and height of 19 feet remain the same. Only the length has changed.

Cut-apart plane is supported by special wooden cradles. New stringers and skin section were overlapped a foot for added strength. Entire rebuilding job took four months.



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nose section and 8.4 feet added behind the wing. New length of plane: 113 feet, 7 inches.

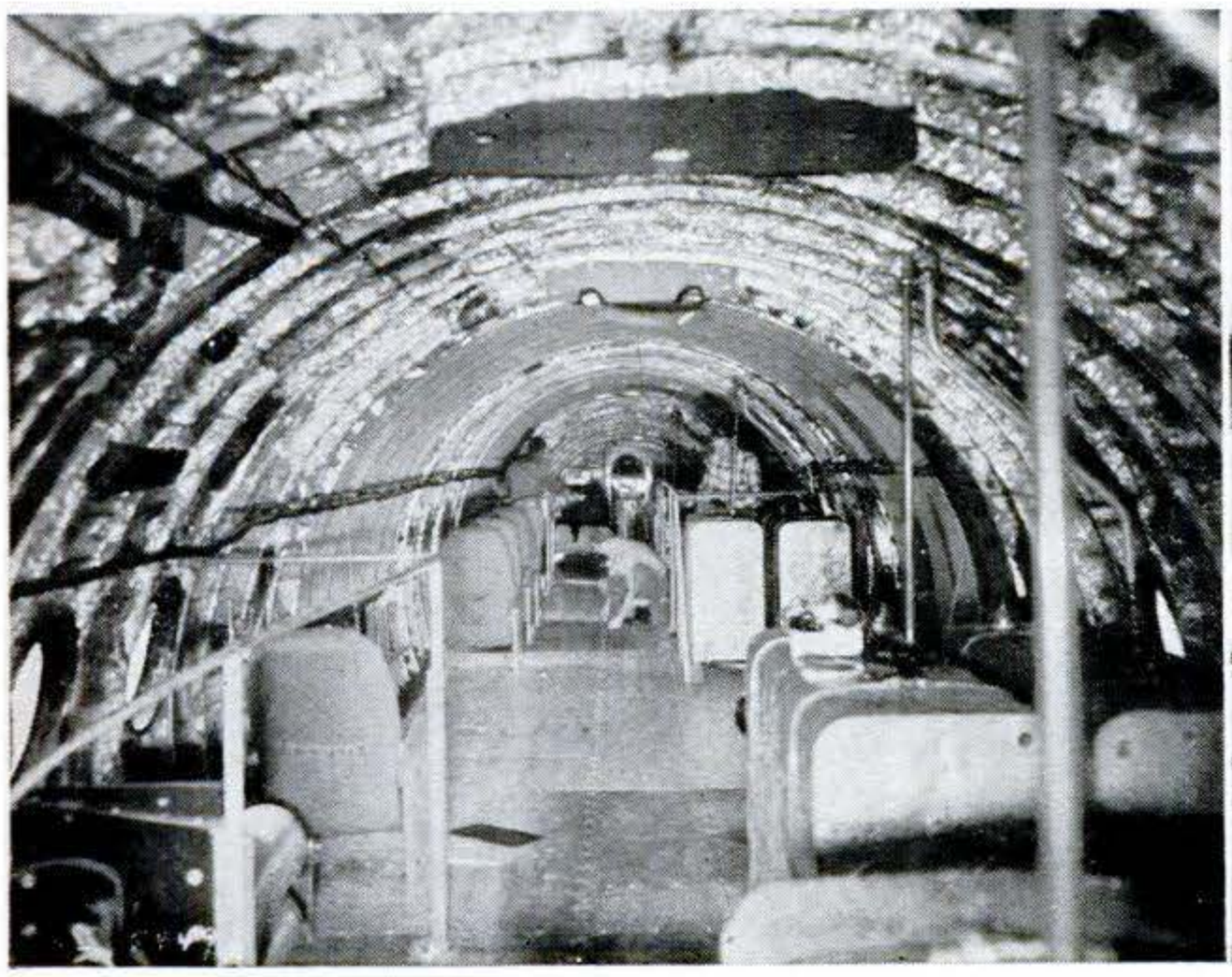
cut was made just ahead of the wing and the other just behind it. The resulting three sections were then separated a predetermined distance. New stringers and rings were added in the open places and a new aluminum skin section—tapered to conform to the original contours—was riveted in place. The total length added was 220.8 inches.

Over-all length of the new transport is 113 feet, 7 inches. It can now accommodate as many as 110 passengers, 41 percent more than the old plane. Baggage and cargo capacity has been upped 72 percent. Additional changes include a combined electrical and pneumatic de-icing system, and wing-tip fuel tanks for long flights.

Basic power plant in the production models will be four 2,700 hp. Wright Cyclones. But the engineers are looking ahead. The ship can also use 3,250-hp. compound engines—piston jobs with exhaust turbines. Finally, the ship can take turboprops when they get the nod for passenger use.

With turboprops, the 65-ton giant will cruise at better than 400 m.p.h. Lockheed, with $50,000,000 in orders already on the books, expects to start deliveries late this year. **END**

Main cabin is 83 feet long. Crinkled aluminum foil is used to insulate the pressurized plane against low temperatures at 30,000-foot altitudes. Tanks carry water ballast for tests.



Compound engines like this one will boost the 2,700 hp. of 18-cylinder Wright piston engine to 3,250 hp. Wings are strong enough to take even more potent turboprop engines in future.

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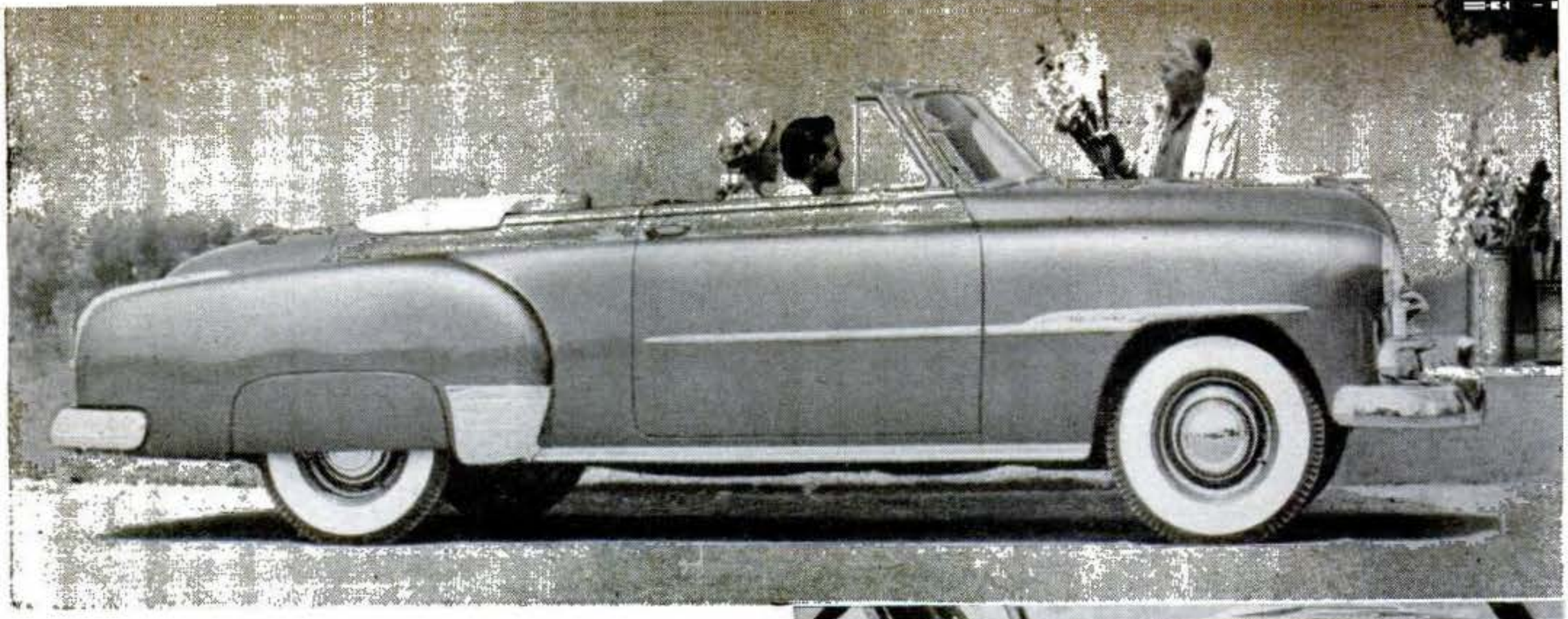
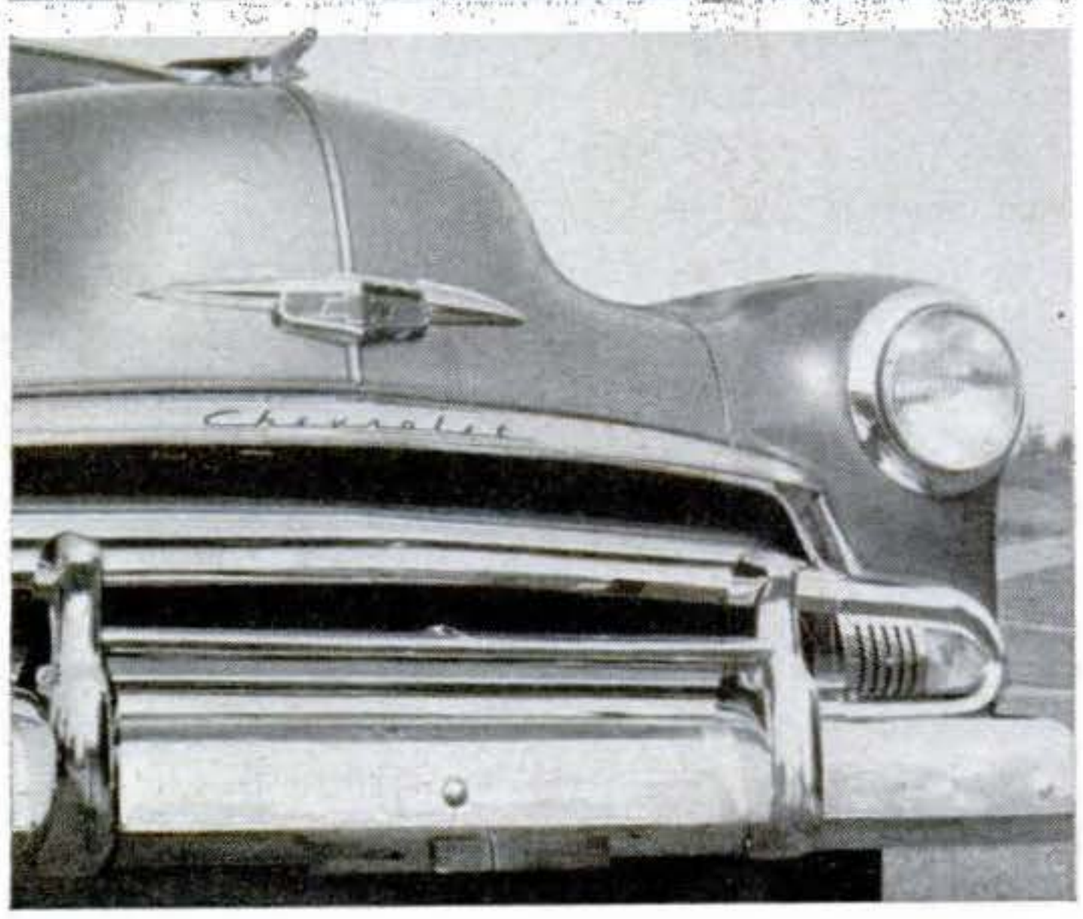


New Chevvie Looks Sleeker



LONGER, lower lines and bigger "Jumbo Drum" brakes highlight a general facelifting job on the 1951 Chevrolet. The new brakes are self-energizing and, according to the manufacturer, require 25 percent less pedal pressure. Rear-fender crowns have been raised and the amount of chromium trim on de luxe models increased. The convertible features a big rear window of flexible plastic, tripling visibility in that direction. For safety all control knobs are recessed beneath the instrument panel. A rounded ledge above the panel protects the windshield from instrument-light reflections. The radiator grille has been restyled and simplified, with the two lower bars extending across the fenders to form a semicircular frame for the parking lamps. Bumper guards and hood ornament are restyled.

Double-Deck Aerial Freighter Breaks Load-Carrying Records

BY FLYING 50-odd tons of cargo halfway across the continent on an Air Force test mission, this XC-99 transport has broken all load-carrying records. The 200,000-ton-mile total would require twenty C-47 transports. Photo shows the new double-decked air freighter and some of its load, which included forty-two 2,300-lb. plane engines.

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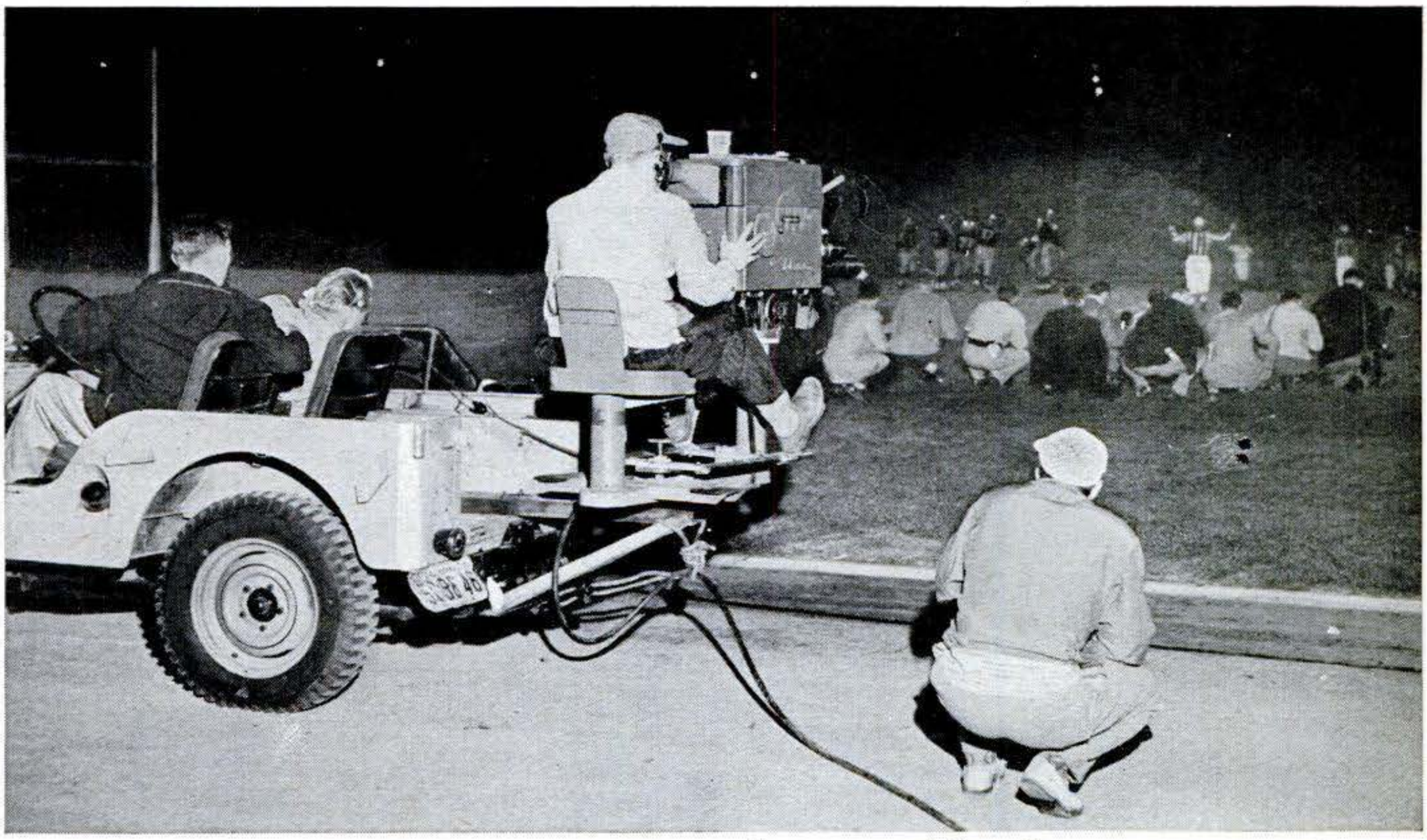
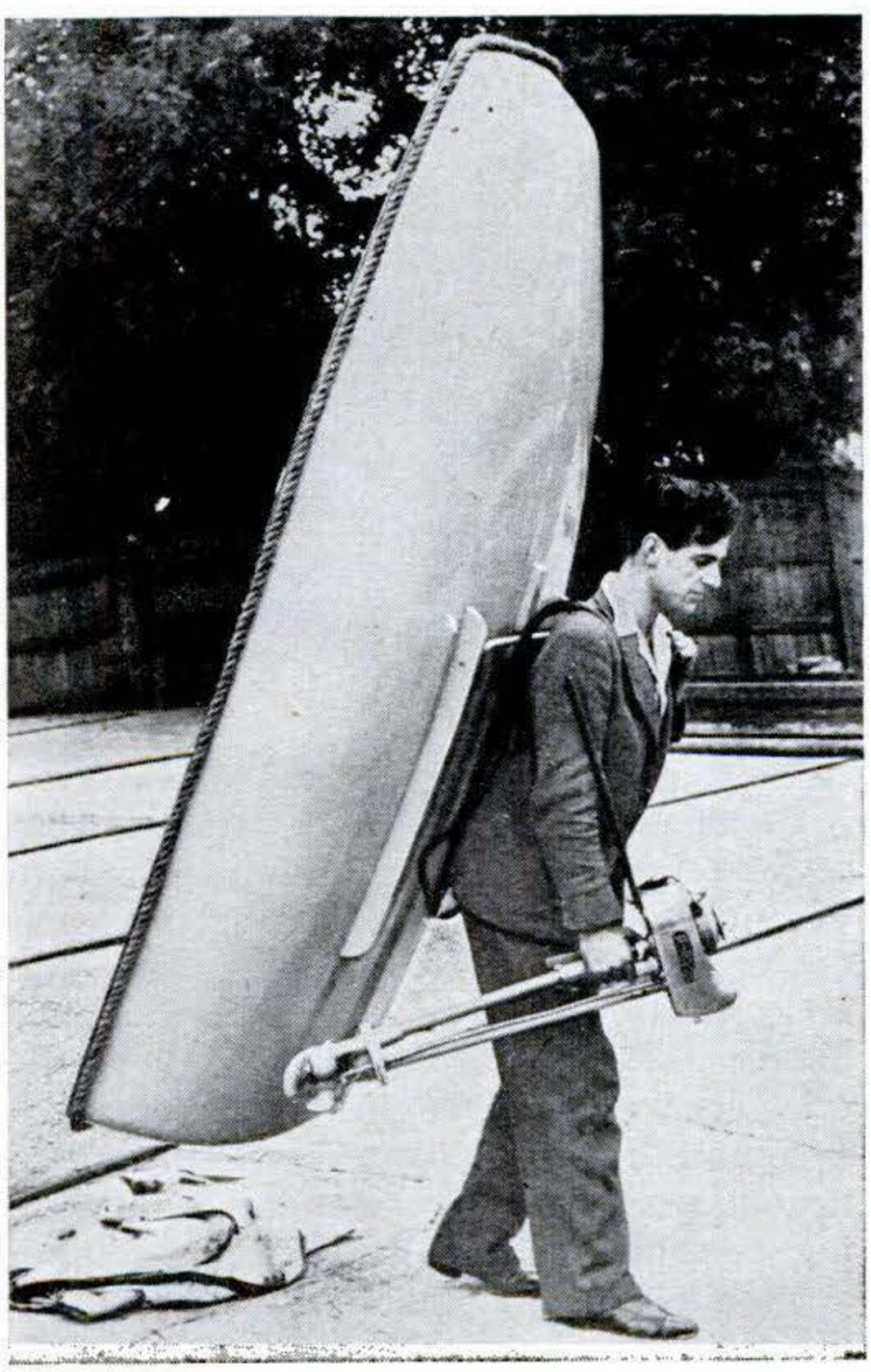


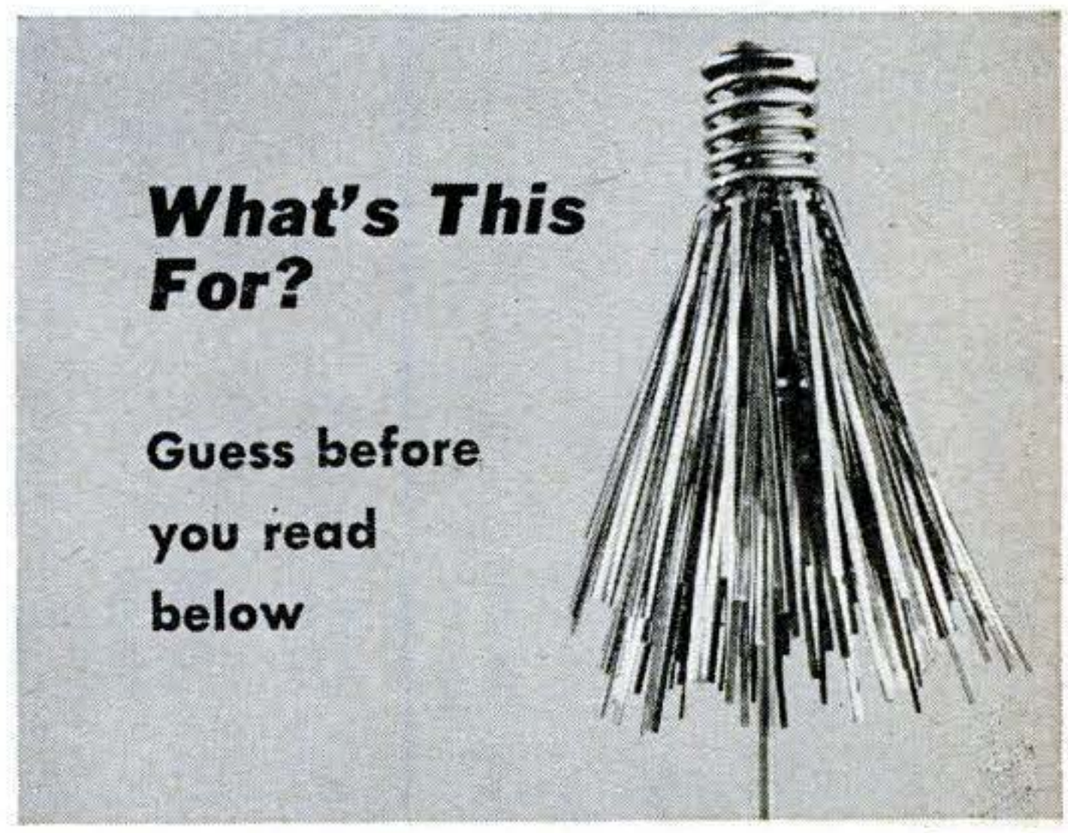
Jeep TV Camera Gets the Action

FAST-action football and other sporting events leap smack into the living room through the jeep television camera above. The mobile rig follows athletes for thrilling close-ups, while other cameras get views at medium and long range. Sid Sanner, engineer for station KTTV in Los Angeles, contrived the mounting by removing the panning assembly from a TV dolly and installing it on a jeep trailing 800 feet of cable.



Glass Boat Weighs 75 Pounds

ONE man can carry the lightweight boat at left, and its motor too. Designed by a British inventor, this three-seater dinghy has a molded hull of spun glass mixed with expanded ebonite, and weighs only 75 pounds. A ½-hp. outboard motor propels it at four m.p.h. A carrying harness aids in transporting it to and from the water.



It's a chimney broom. The steel-bladed brush collapses to the folded position shown, so that you can push it all the way up a chimney from your kitchen or basement with a 40-foot steel push rod. When it has reached the top, you pull down and the brush opens, scraping soot out of the chimney. Called the Collapso and sold for $4.95, it has been introduced by the Flour City Brush Co., Minneapolis, Minn.

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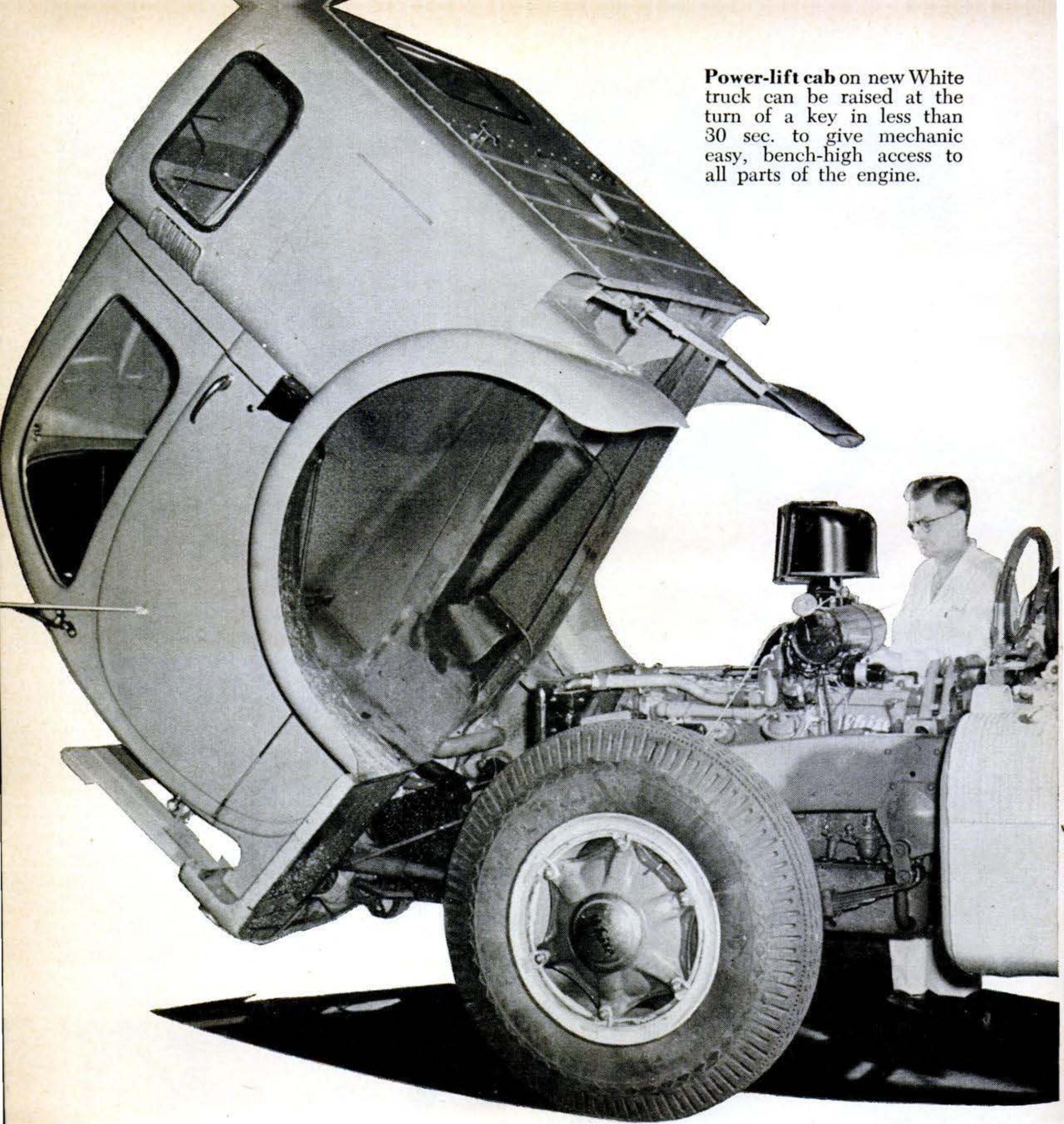

Power-lift cab on new White truck can be raised at the turn of a key in less than 30 sec. to give mechanic easy, bench-high access to all parts of the engine.

Truck Cab Tips Up for Service

PS PHOTOS BY HUBERT LUCKETT

ALTHOUGH it may look like a conventional cab-over-the-engine truck or trailer tractor, the new White Motor Company version has a power-lift cab that simplifies engine maintenance and repair. Unlocking and operating a conveniently located control handle lets you raise the cab quickly to give easy access to the engine and accessories. Ingenious linkage and universal joints make it unnecessary to disconnect any of the driving controls such as the steering column, gear-shift lever, or brakes before raising the cab to its tilted position.

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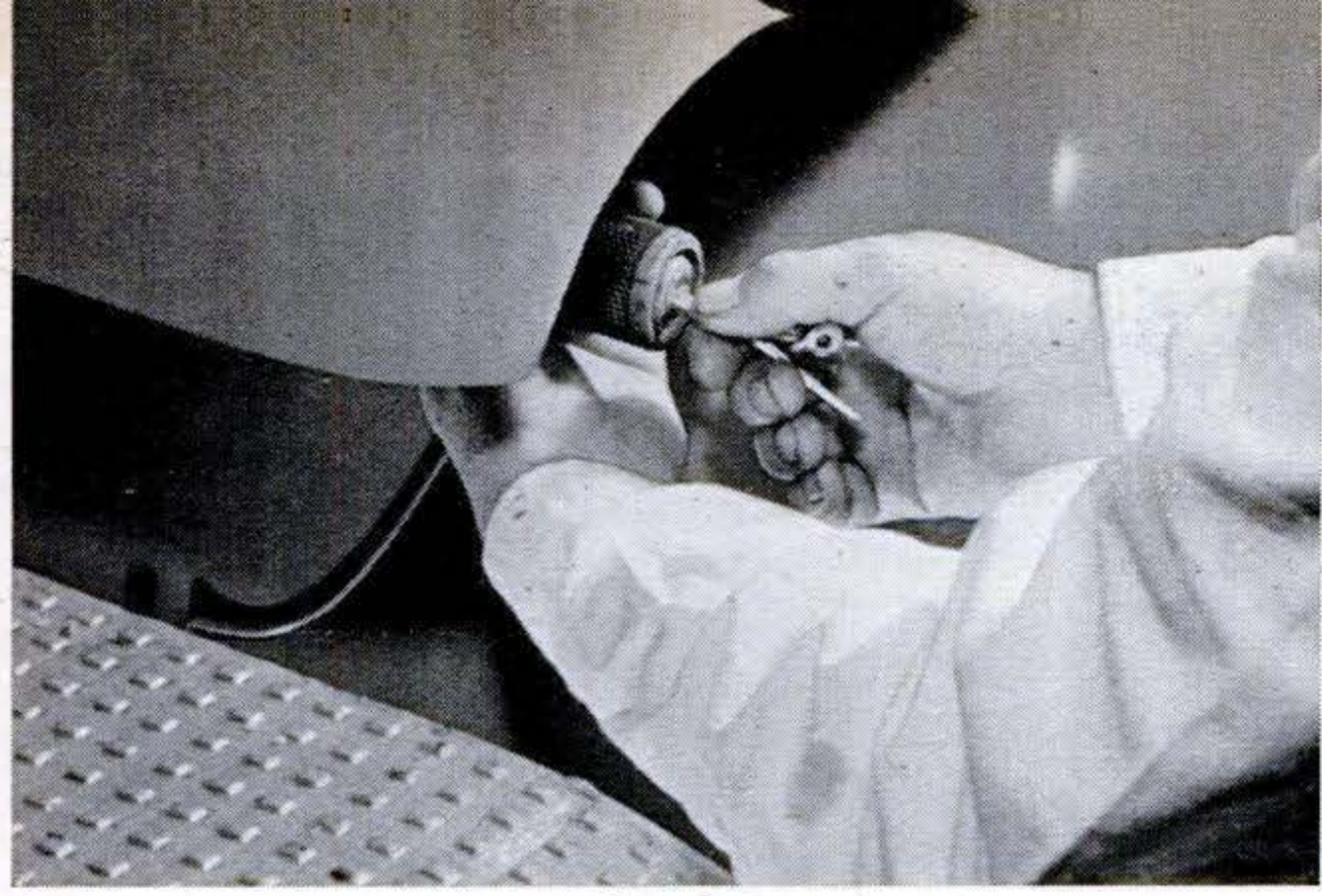
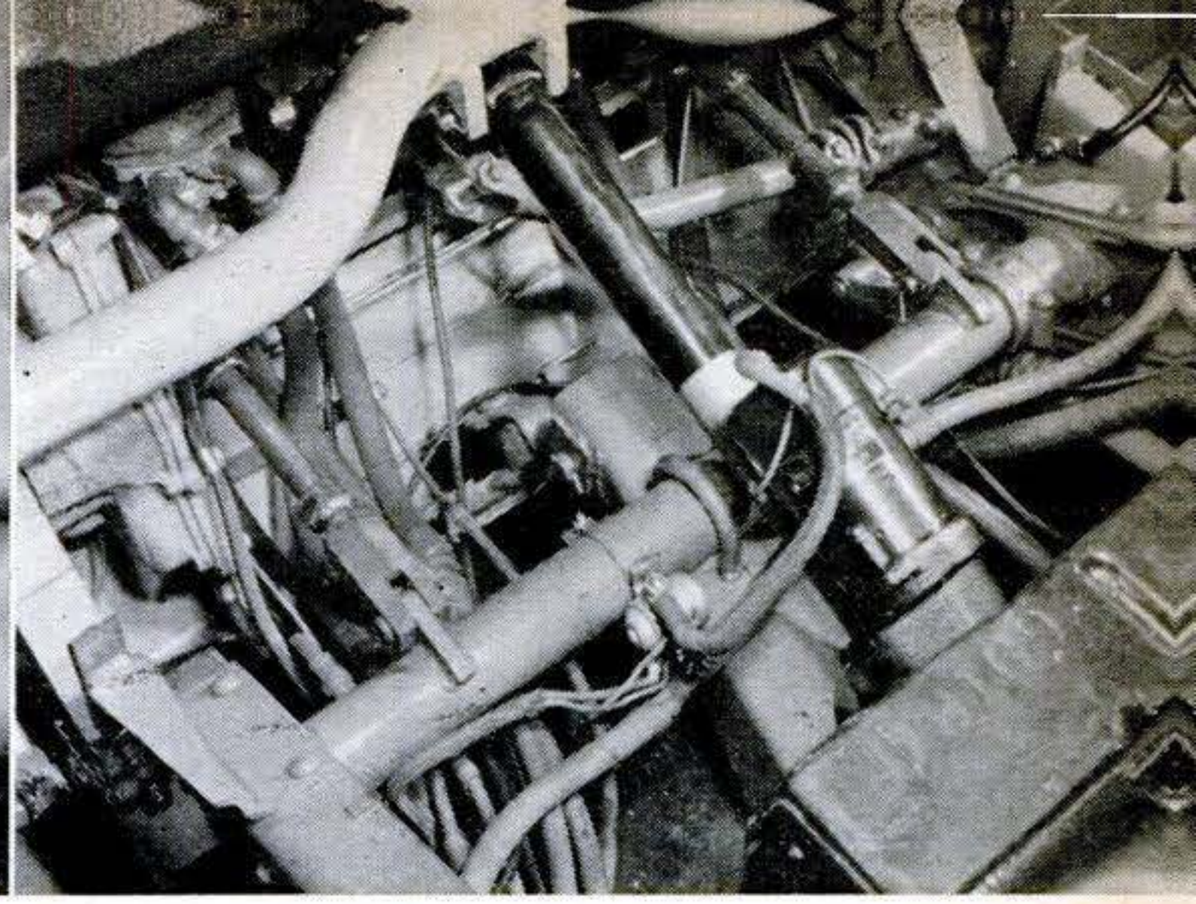
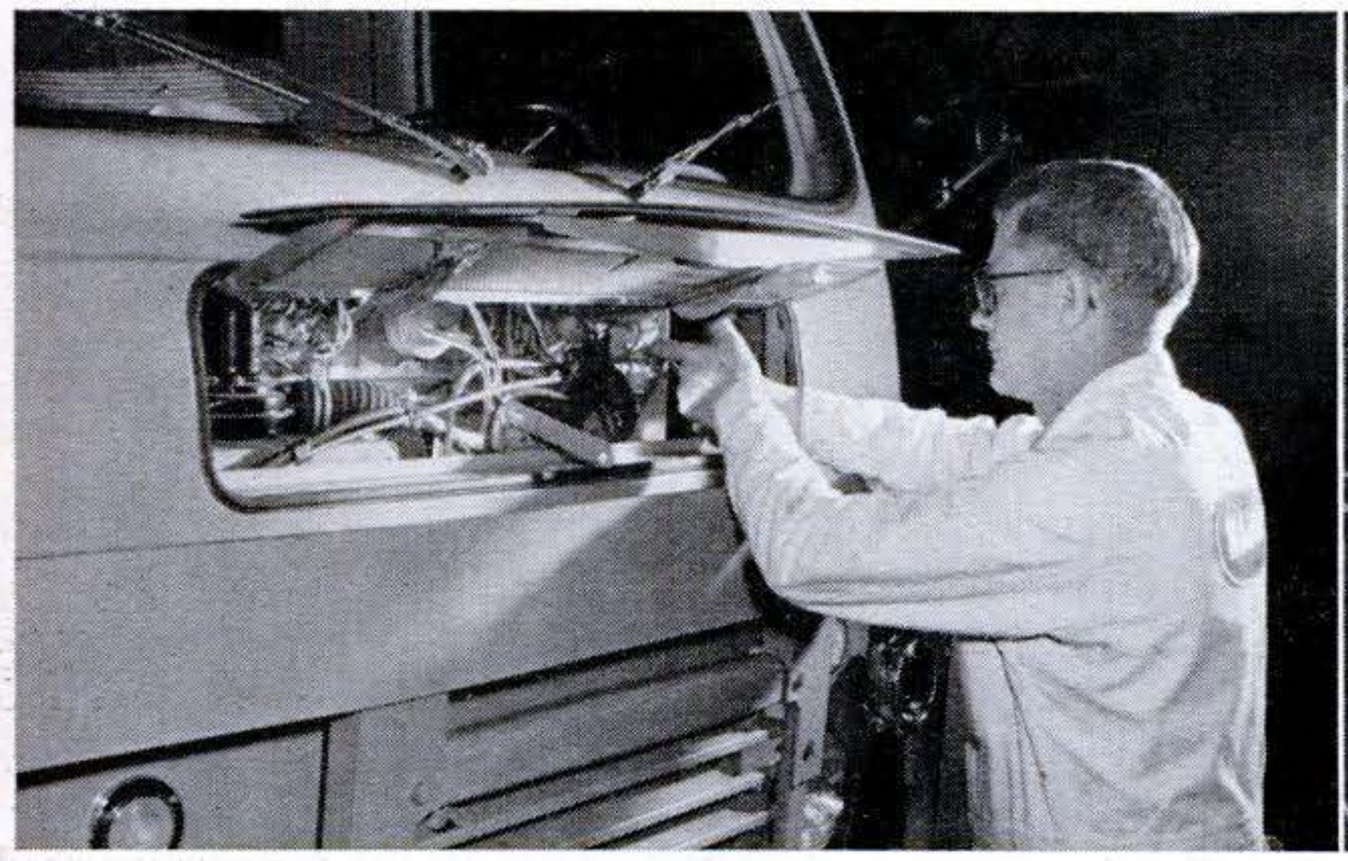


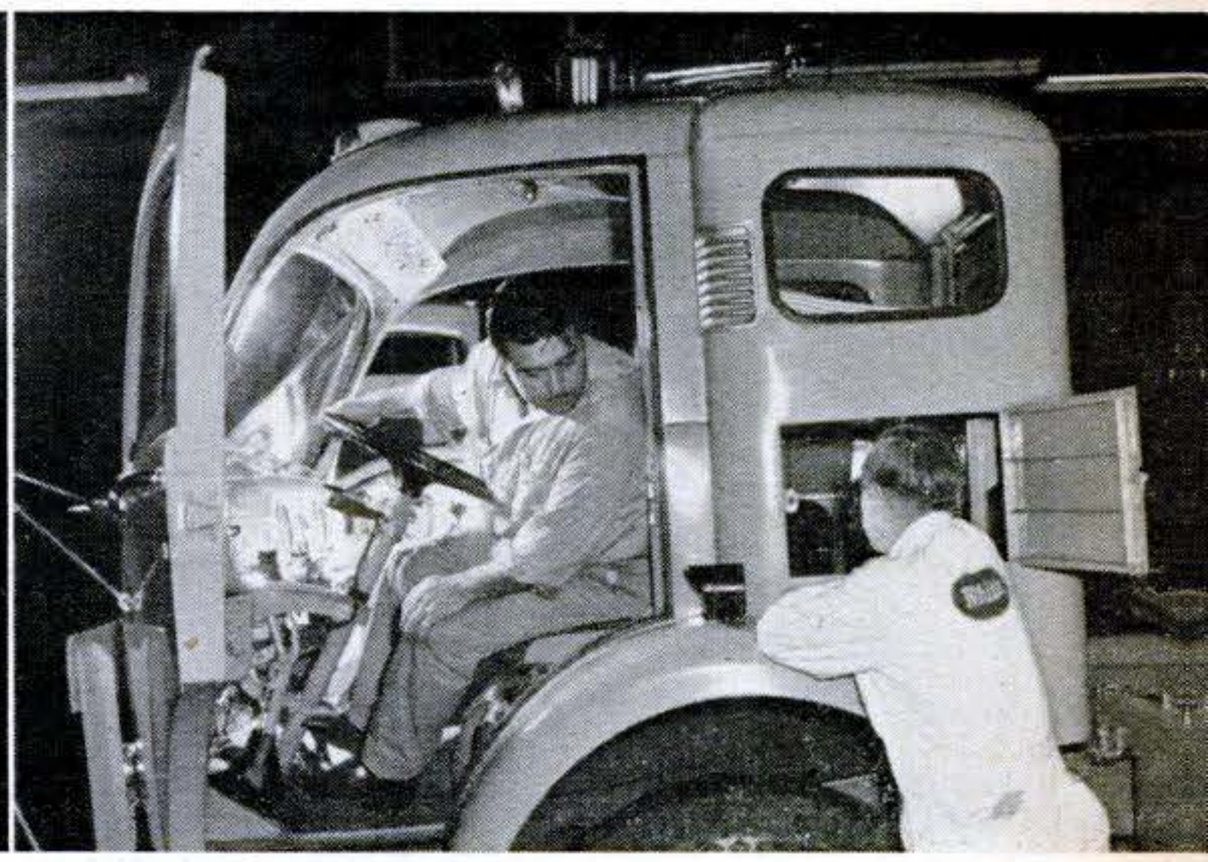
Cab control is located under the rear of the cab on the right-hand side. The ignition key unlocks the control. Twisting the handle forward or backward raises or lowers the cab.



Lifting mechanism, consisting of an electrically-operated screw jack (center), is a modified version of the mechanism used to actuate the landing gear on many large airplanes.



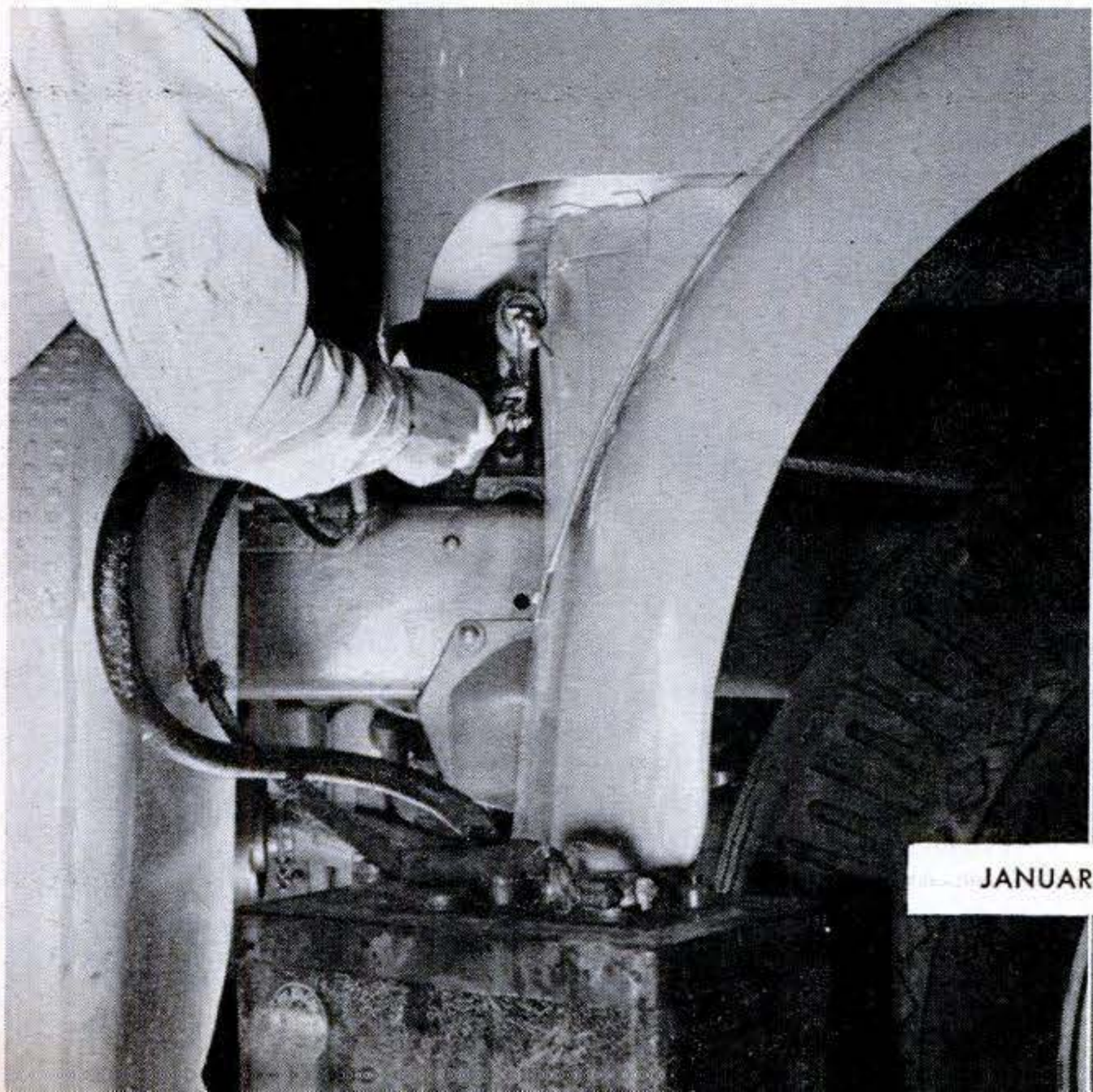
Ease of maintenance was the target in designing the new power-lift cab. Ventilation panel on front of cab opens up to provide handy access to the rear of the instrument panel.



Daily maintenance, such as water and oil checks, can be taken care of easily through access door on the side of the cab. The cab design gives the driver excellent visibility.

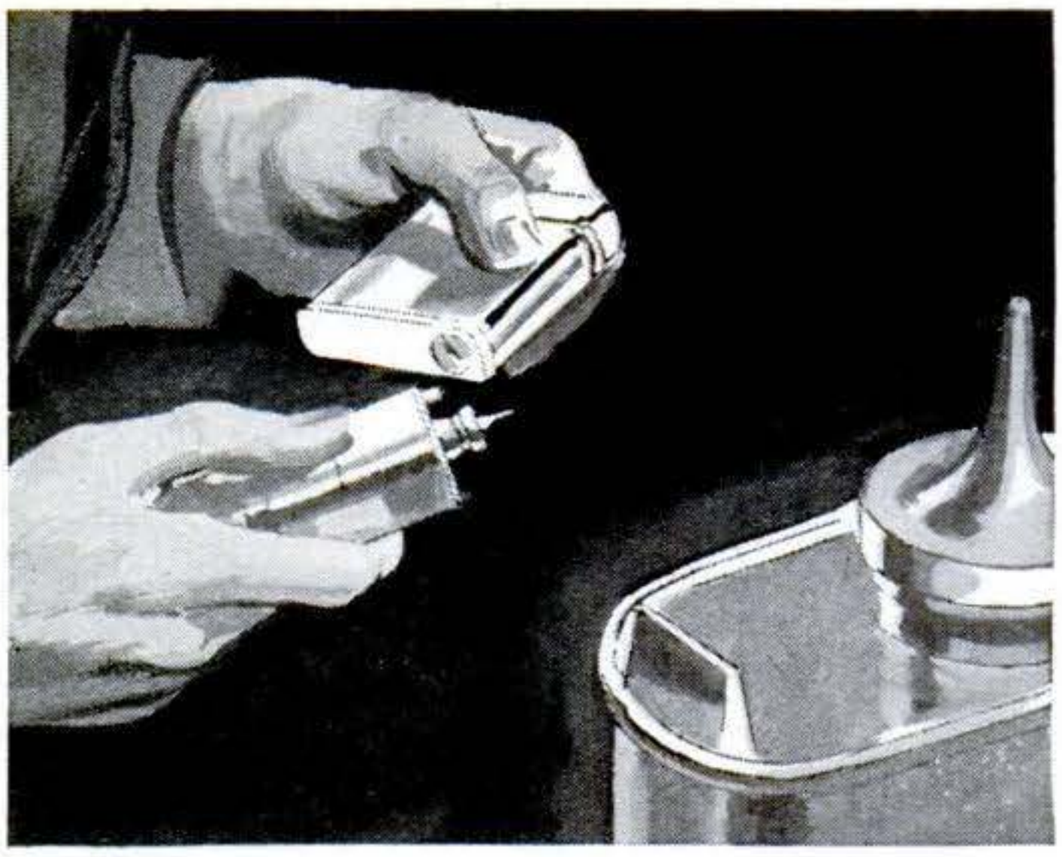
Emergency electric power, for lifting the cab in case the battery goes dead, can be obtained by connecting a spare or stand-by battery to a power connection under cab-control handle.

Two-speed rear end provides for a range of ten speeds. To shift from one range to the other in each of the five shift-lever positions, driver simply moves button on side of lever.

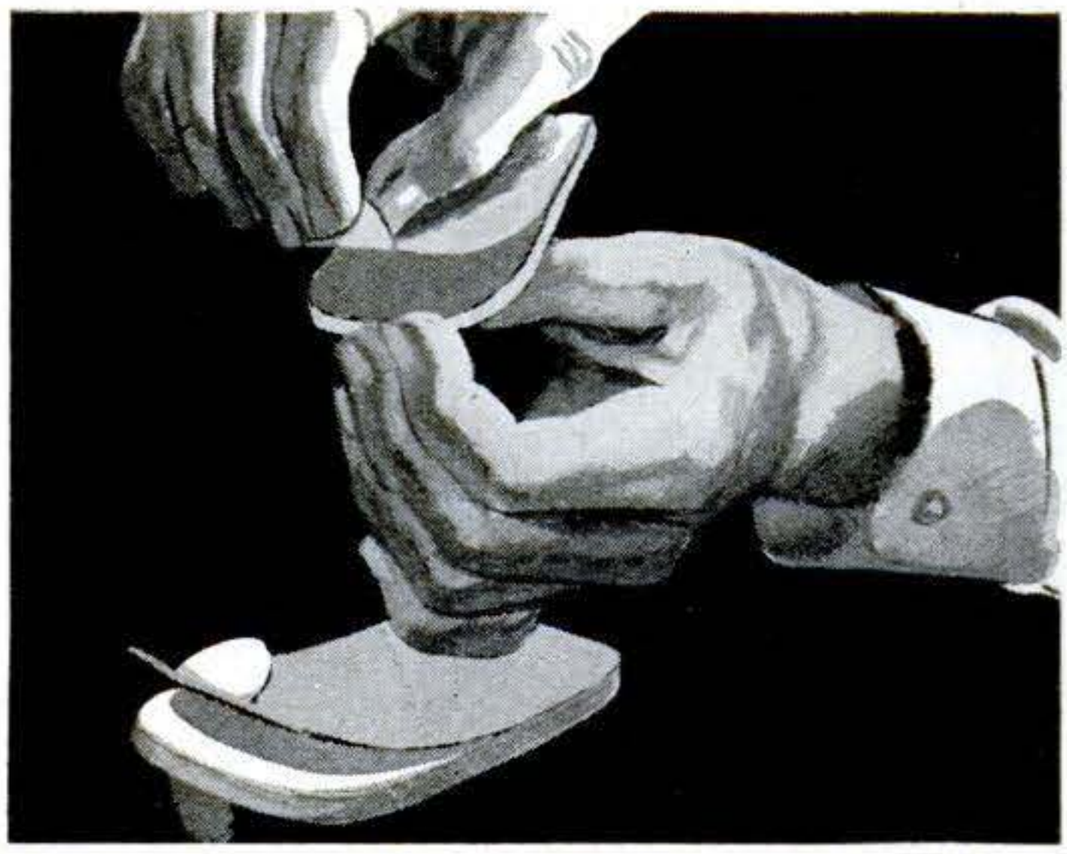


I'd like to see them make . . .

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

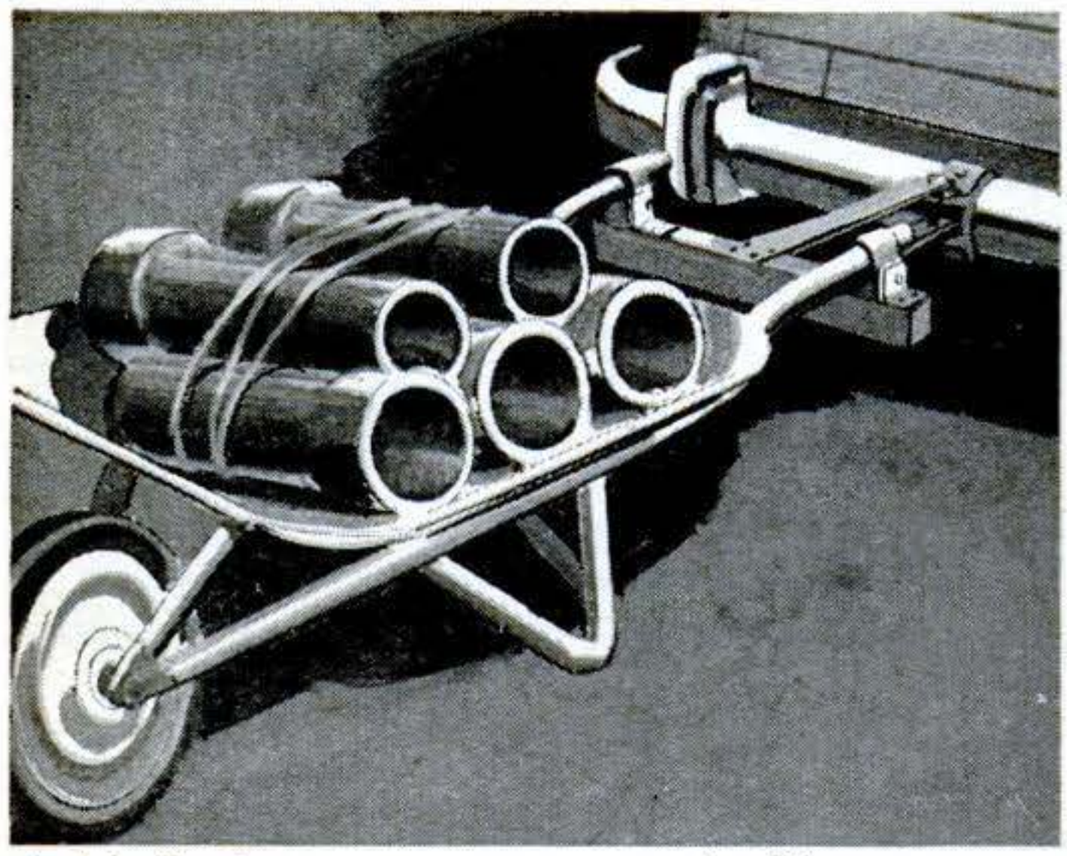


Lighter-fluid cans with built-in screwdrivers sized to fit the filler screws in cigarette lighters. This would eliminate hunting for a screwdriver —or even fishing for a coin—every time you fill up.—*Sam Shelton, The Bronx, N. Y.*



Rubber tire patches with tabs on the fabric separators that cover the sticky surface. By grasping the tab and pulling, you could easily detach the fabric from the rubber patch.—*Edward Olasz, New Brunswick, N. J.*

A pressure canner with a spigot. Then, after the cover is removed, the hot water could be drawn off. No need to lift the heavy water-filled canner or to remove the jars until cold.—*Mrs. E. Meneghini, Norway, Mich.*



A hitch for converting a wheelbarrow into an automobile trailer. Would serve fine for carting garden debris and other trash for dumping, saving interior of car from scratches and dirt.—*Gilbert Roberts, Albany, N. Y.*

Ready-made frosting in disposable plastic tubes, made to fit interchangeable decorating nozzles. Would eliminate fuss of making frosting and filling and cleaning fabric or metal gadgets.—*Patricia McGrath, Essex, Conn.*

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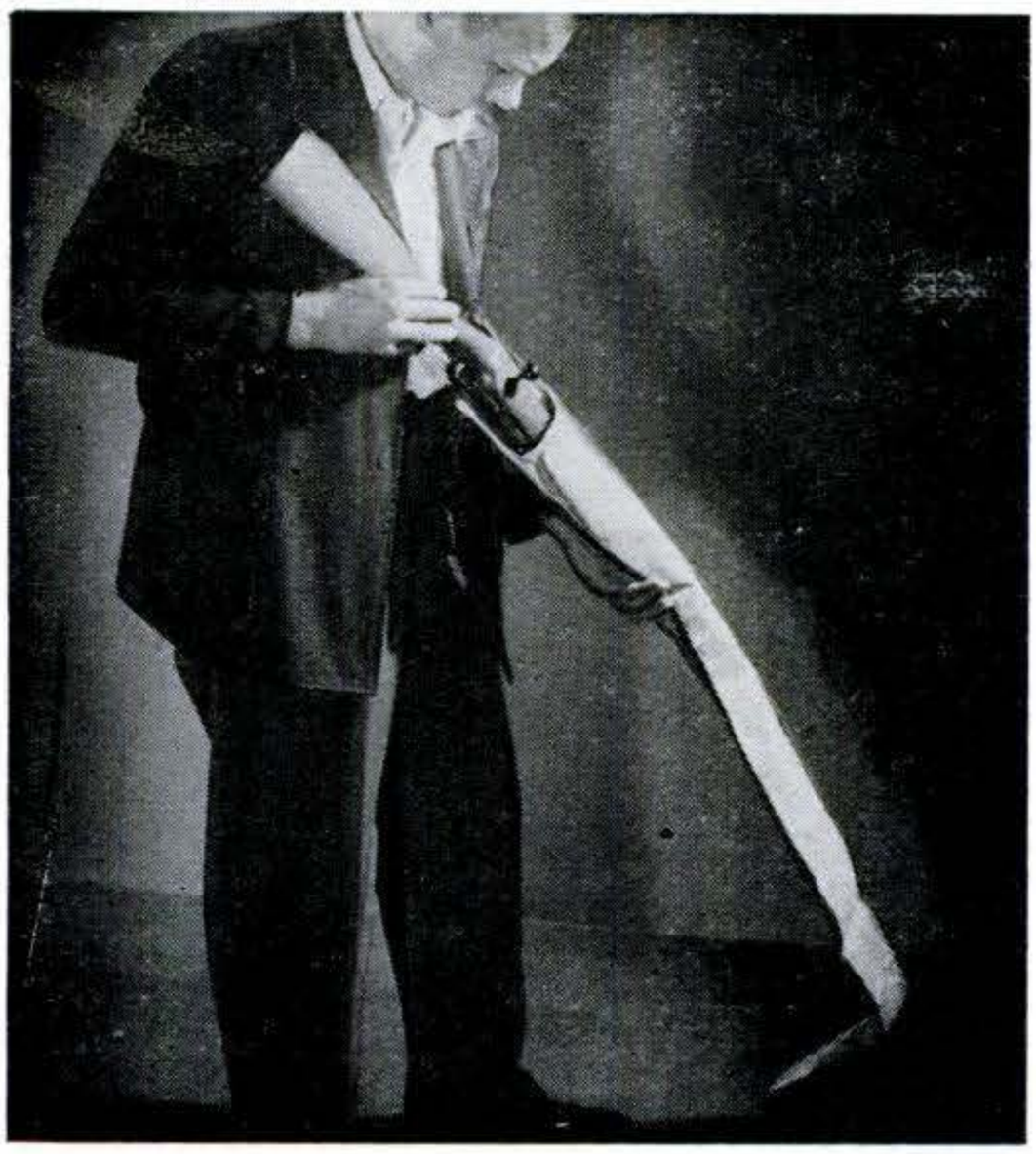
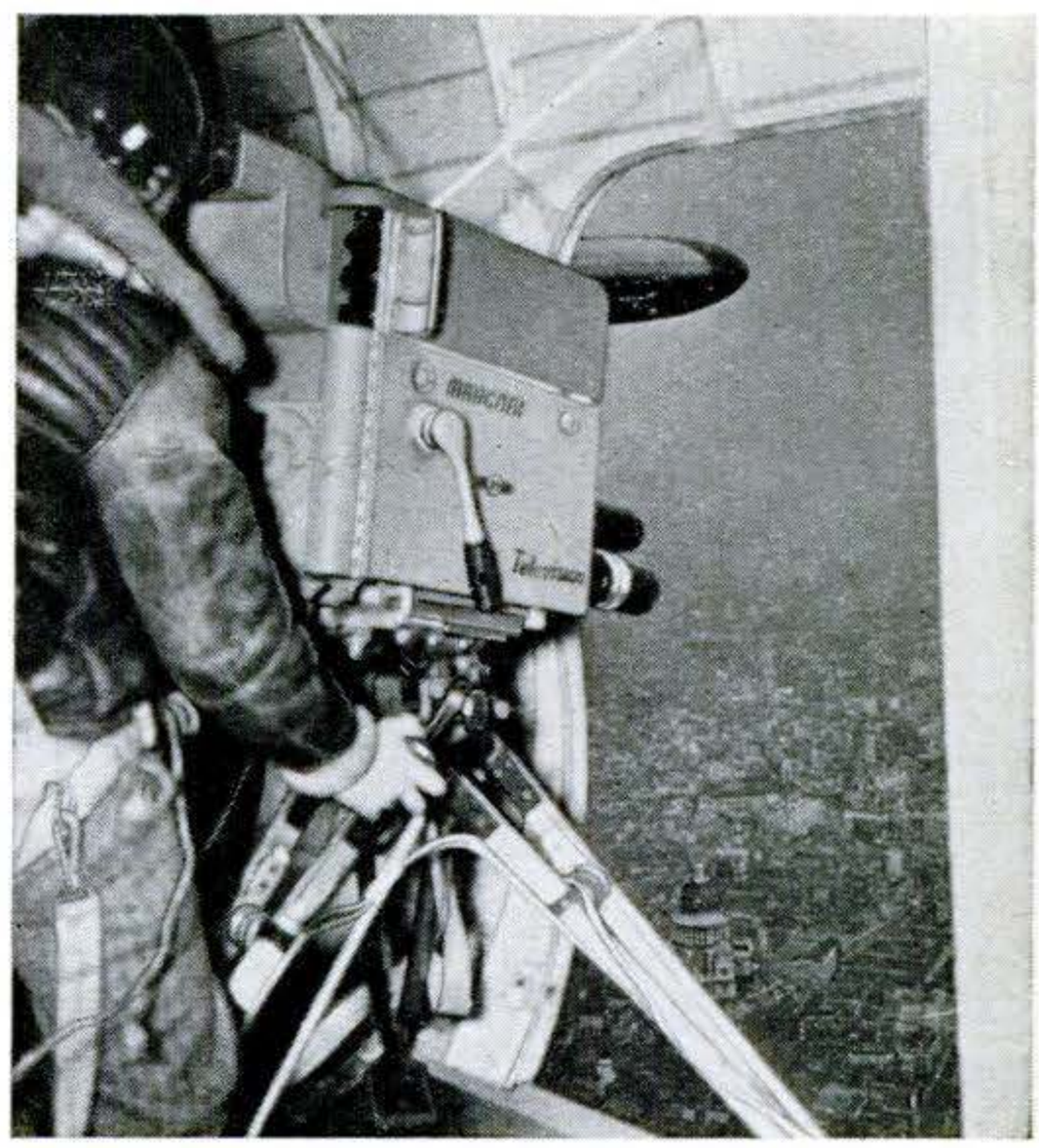


Treated Gun Case Prevents Rust

THE hunter above is using a Pro-Tek gun case to keep his shooting iron from rusting. It's made of a heavy, machine-stitched paper that has been impregnated with a new chemical, called VPI and developed by the Shell Oil Company. Its vapors do not absorb water but chemically inhibit rust. It's sold for $1 by Pro-Tek, Burlingame, Calif.

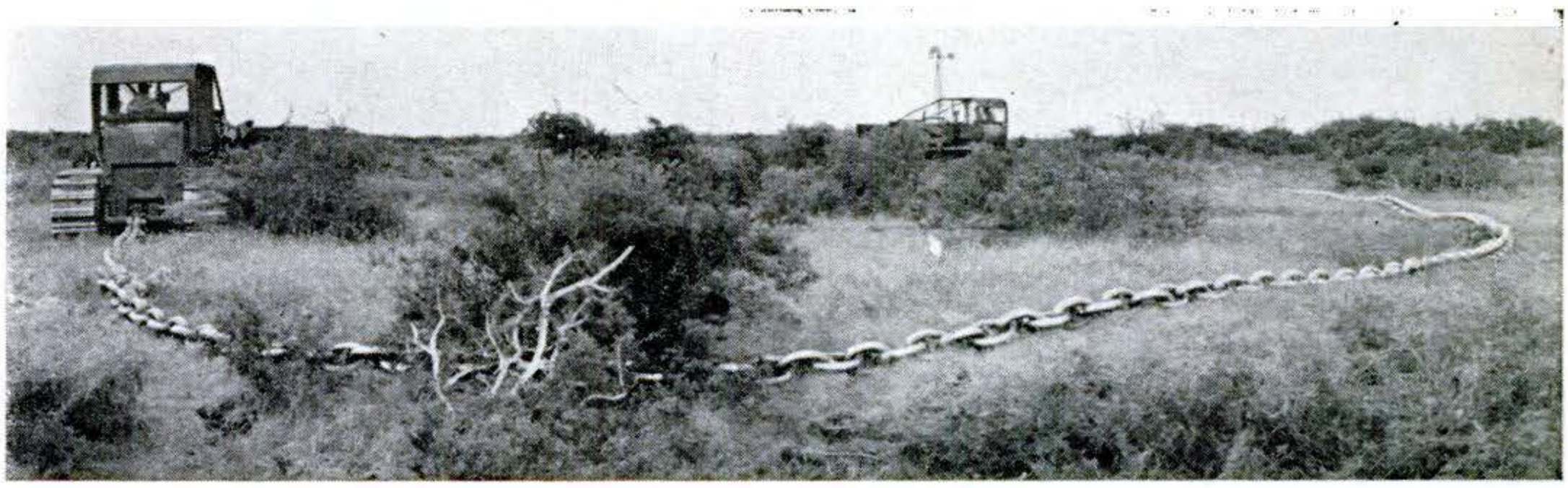


London Televised from Plane

LONDON TV fans got a bird's-eye view of their home town recently without leaving their armchairs when the British Broadcasting Corp. sent a television camera crew up in a Bristol cargo plane (above). A portable transmitter in the airplane relayed the aerial scene down to the ground station during the experimental telecast.

Homemade Racer Hits 176 M.P.H.

ONLY 17 feet long, the tiny racing plane at left was designed, built, and flight-tested by Neal Loving, of Detroit, a double amputee. The midget racer, which has done 176 m.p.h., has unusual inverted-gull wings that double as part of the undercarriage. It also sports such special instruments as a stall indicator and an electric lap counter.



Land Cleared with Battleship Chain

THE mammoth 25,000-pound chain shown above is dragged along by two 148-hp. Diesel tractors to clear Texas pasture lands. Trees up to 22 inches in diameter are easily ripped from the earth by the 262-foot chain that once hauled a battleship anchor from the ocean bottom. It's said to clear 40 acres of ground in an hour.

Copyrighted material

To create one of San Francisco's famous cable cars, TV needs only a couple of "flats," a platform, and a movie screen. Movie background of real street scene is faintly visible at the left.

Movies Put San Francisco in New York TV

PS PHOTOS BY W. W. MORRIS

FOR 19 years the color of the San Francisco locale has been a hallmark of the radio story "One Man's Family." That the program was actually broadcast from Hollywood didn't matter much to the audience or the producers. On television it's not so easy.

To preserve the San Francisco flavor in the video version—staged inside a converted movie studio in New York—the show's originator, Carlton E. Morse, called on photography for help. In San Francisco, photographer Ray Moulin shoots stills and movies.

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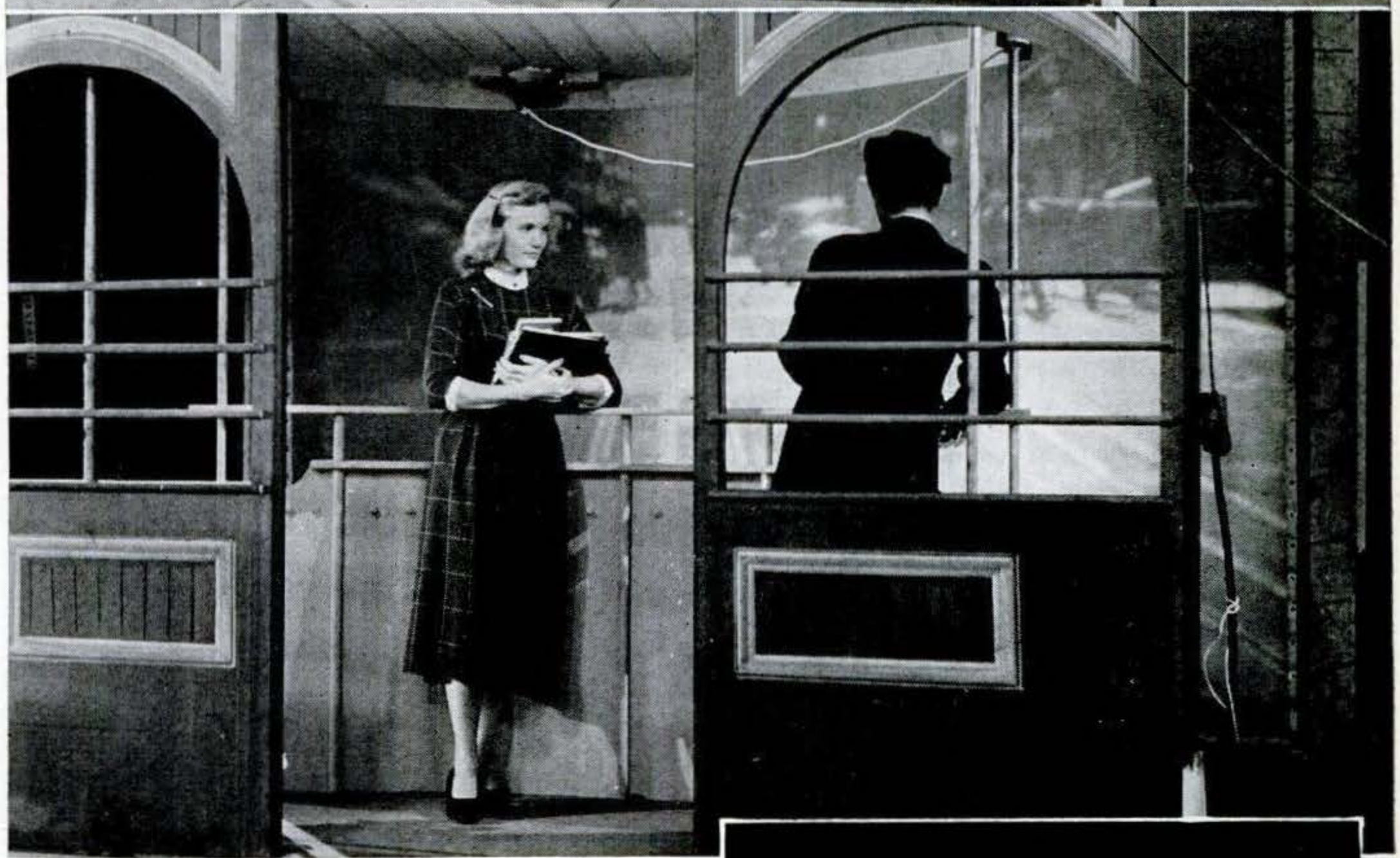

From approximately same angle used by TV camera, top picture shows how cable car looks with movie background off. Lower photo shows effect of switching on projector, behind screen.

In New York, these pictures are combined with actors and simple but imaginative sets to bridge the 3,000-mile gap.

The TV audience sees the familiar characters—in New York—but against settings unmistakably San Franciscan, such as inside a cable car moving up the steep hills, in a speedboat in the bay, or in a living room with Golden Gate bridge seen through a window. **How video magic does the trick is shown in photographs on this spread and on the next page.**

This is what the audience sees: Claudia and Cliff in a cable car moving up a San Francisco street. Photo was shot from receiver screen.

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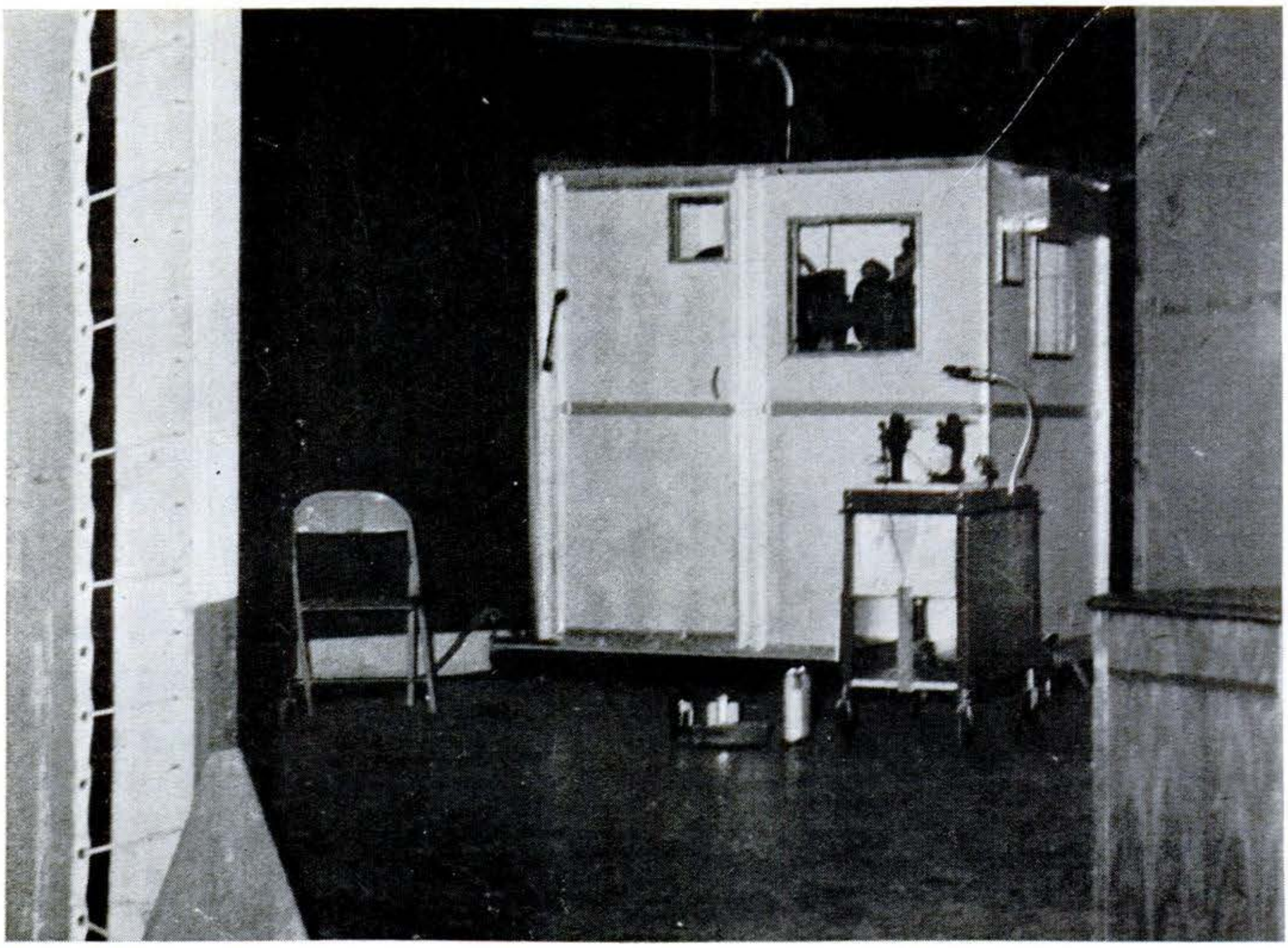
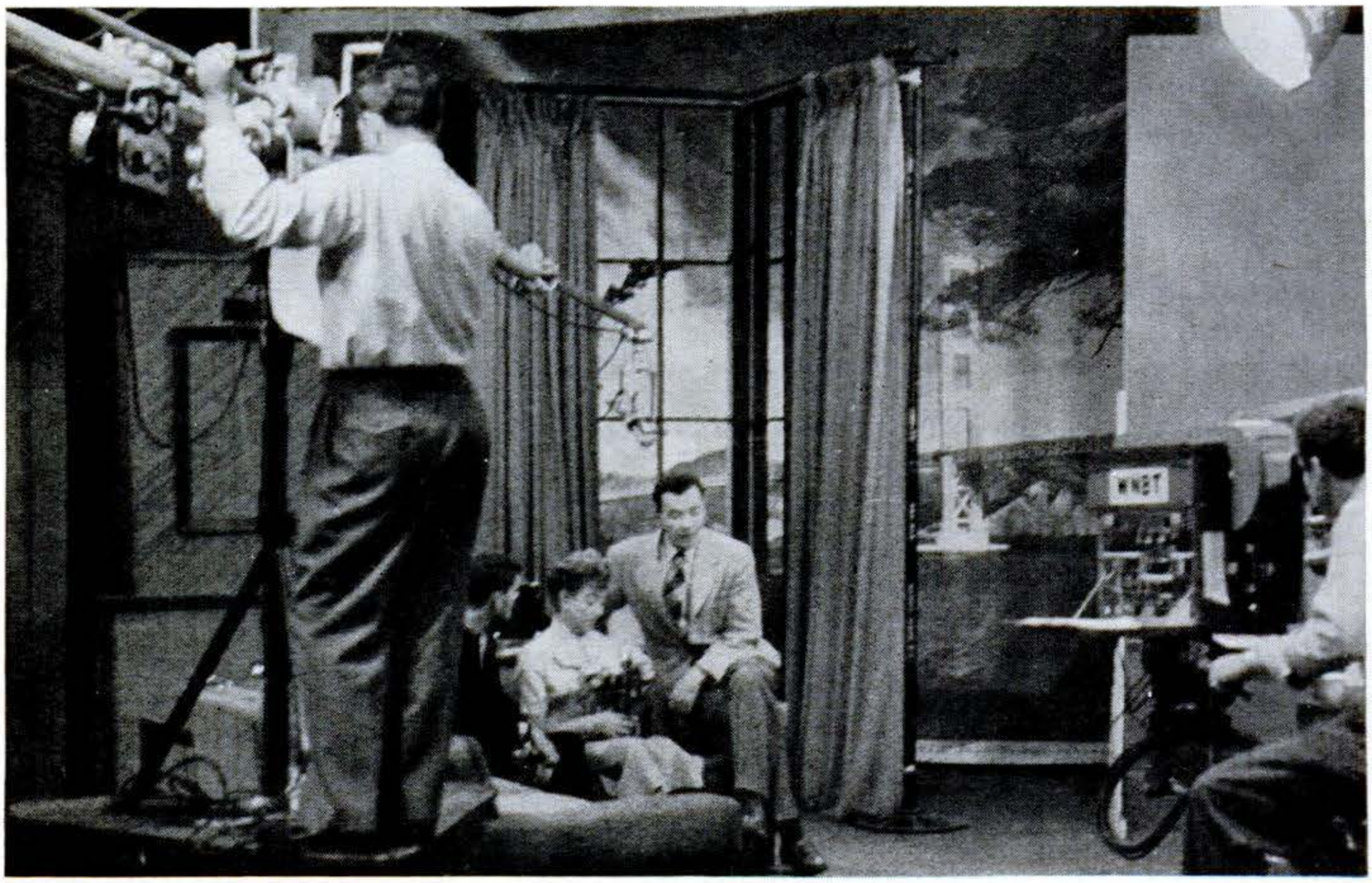


Special Holmes 16-mm. projector, in portable soundproof booth, is used by N.B.C. to create movie backgrounds. Projector, designed to convert 24-picture-per-second movies to match 30-picture-per-second TV scanning, is parallel to screen. Mirror changes light direction.



Still photographs help create the San Francisco atmosphere, too. In picture above, giant enlargement of a view of the Golden Gate bridge can be seen behind the "windows" of the set. Photograph gives an unusual effect of depth, making a realistic scene when televised.

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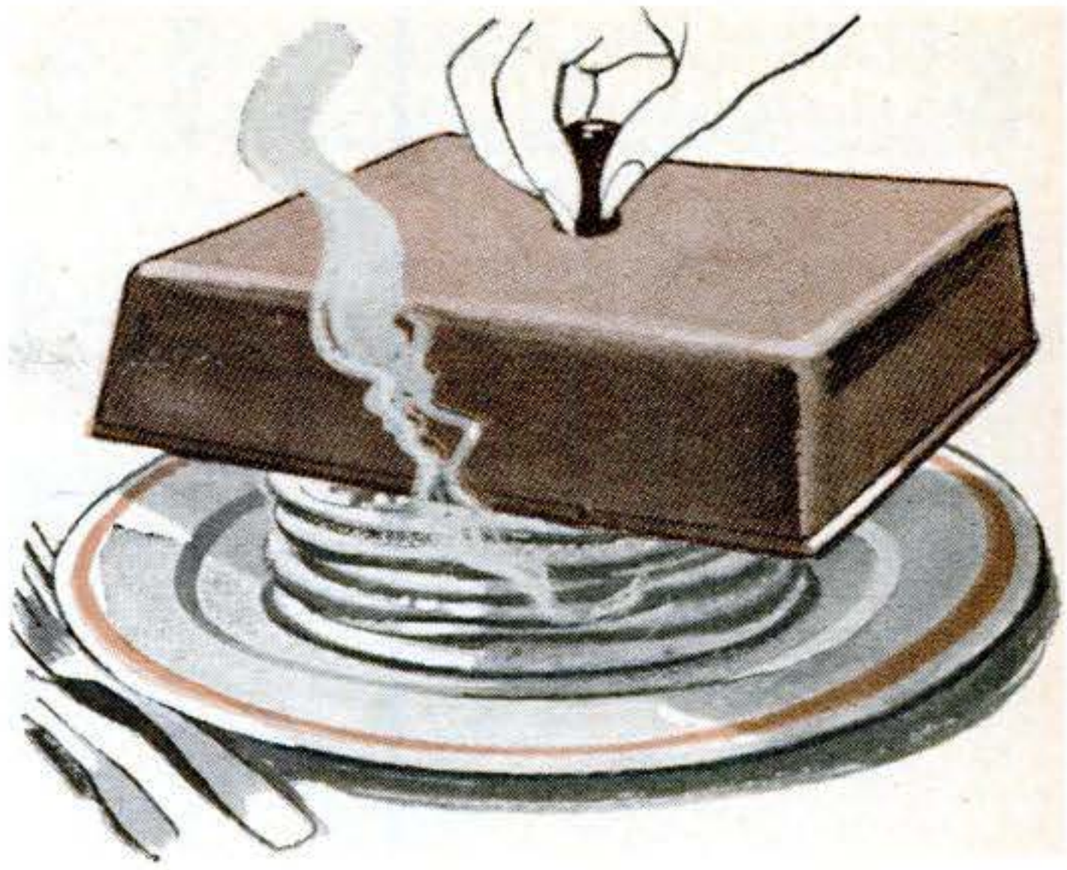
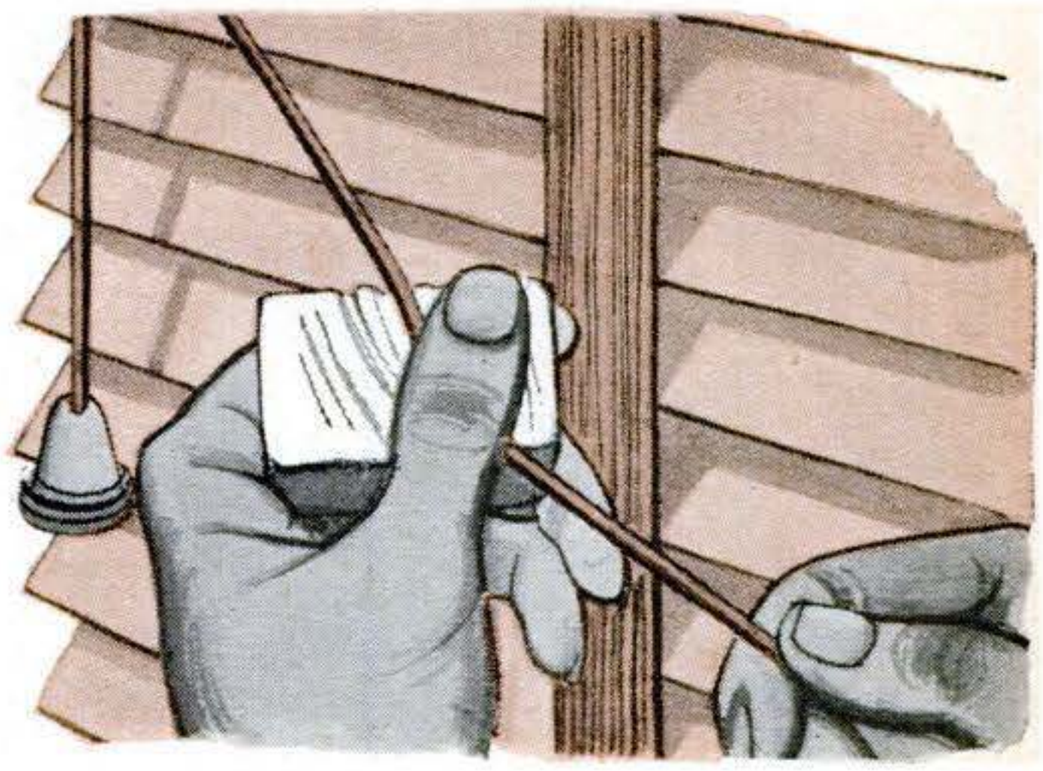
Keeping the Home Shipshape

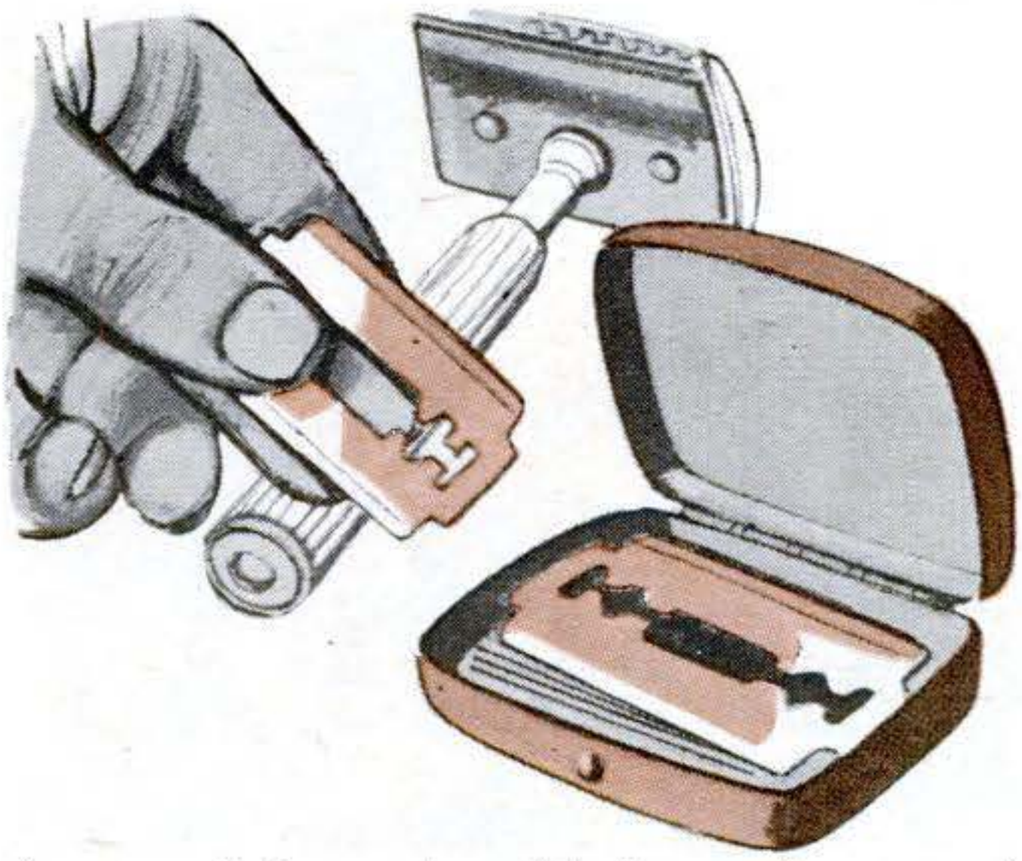
Hate to clean the electric stove? Cover the reflector pans under the burners with aluminum foil. Foods that spatter or boil over will be caught by the disposable foil.



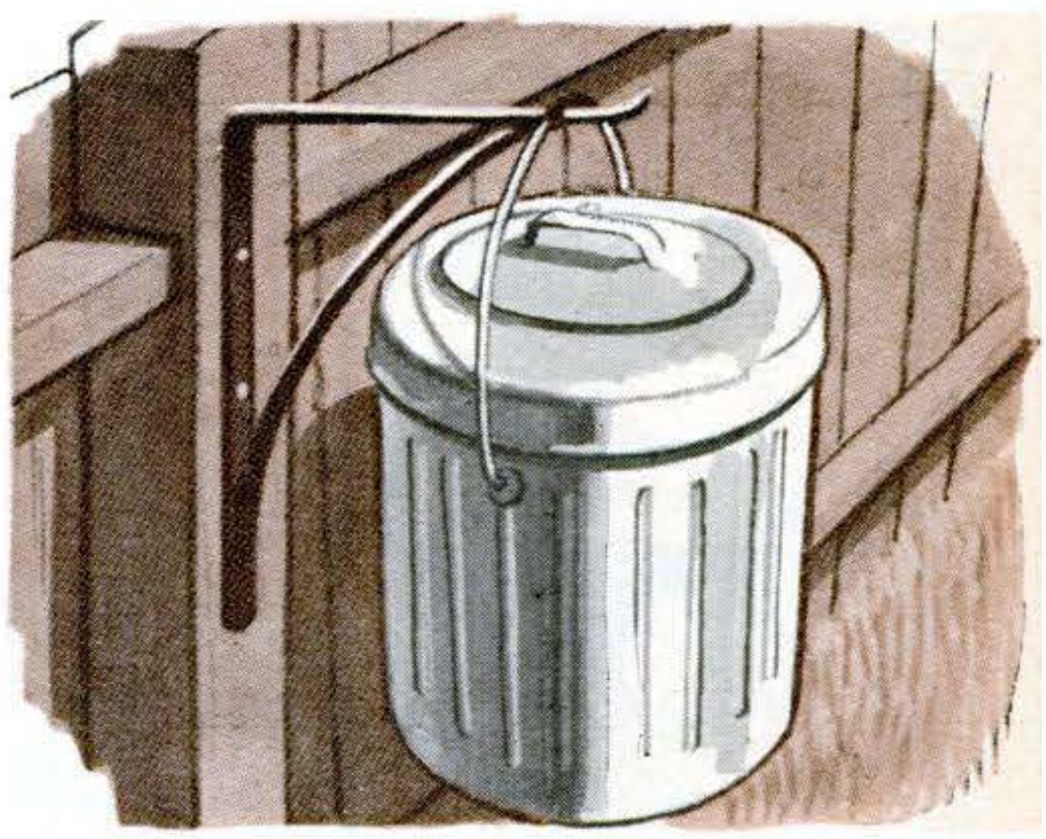
Is your family fond of pancakes or french fries? To keep the platter hot between servings, cover it with a deep cake pan. Screw a knob in the bottom for easy handling.



The cords on metal Venetian blinds wear out from rubbing against the sharp edges. If you wax the cords by rubbing them over a block of beeswax, they will last much longer.



An emptied metal aspirin box makes a good depository for used safety-razor blades. When filled with blades, the covered box can be safely discarded with other rubbish.



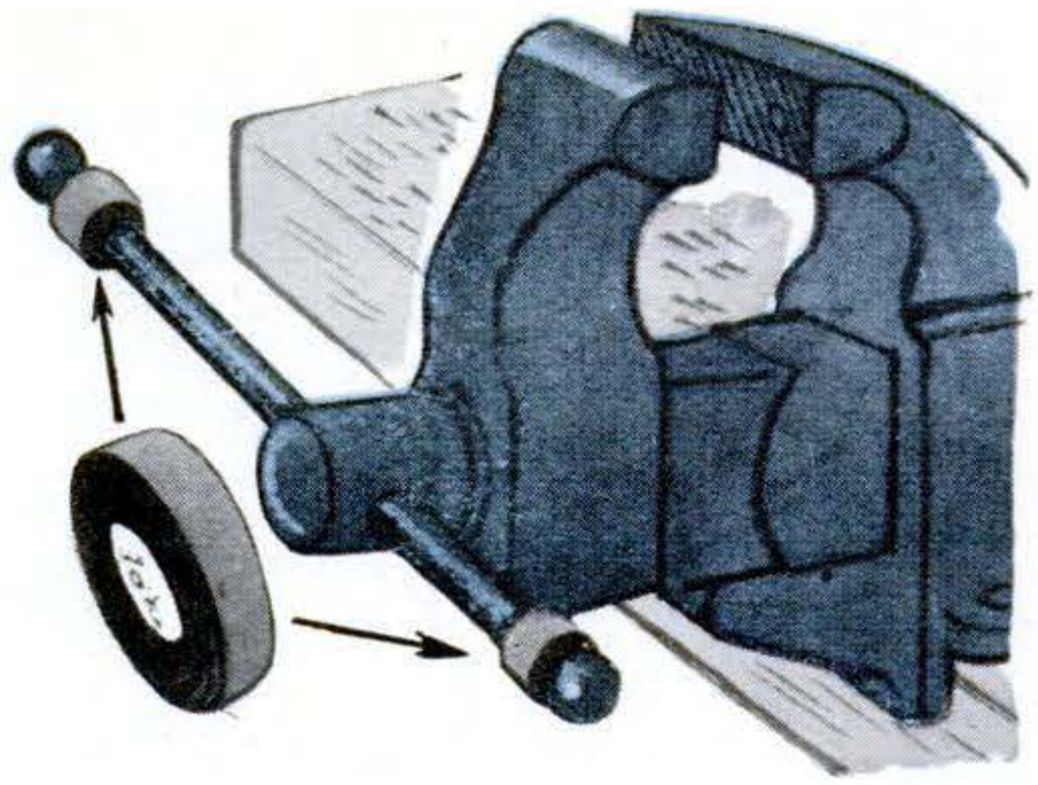
Hang your garbage pail from a back-porch upright or a fence post. Lifting it from the ground prevents dogs and cats from upsetting the can and also keeps the bottom dry.

Please turn the page for five more suggestions.

Copyrighted material

Keeping the Home Shipshape

To make cellar stairs or slippery outdoor porches skidproof, mix an equal quantity of fine white sand in the final coat of deck enamel. Stir frequently while applying.



The handle of a vise often slides down with a bang and pinches the fingers. Wrap friction tape around the sliding handle just ahead of the knob on each end—no more pinching.

You can salvage those stubby pencil ends for further use with a bit of large radio spaghetti tubing. Two stubs with eraser ends butted in the tube then give you a two-ended pencil.

Discarded phonograph needles make good glazing points. Holding the needle shank flat against the pane, drive it down below normal putty line. Leave ¼″ of shank exposed.

Baby foods are easily heated in Pyrex custard cups set in a pot of hot water. For a handy feeding tray, cut holes in a piece of plywood, glue on spools for feet, and coat with lacquer.

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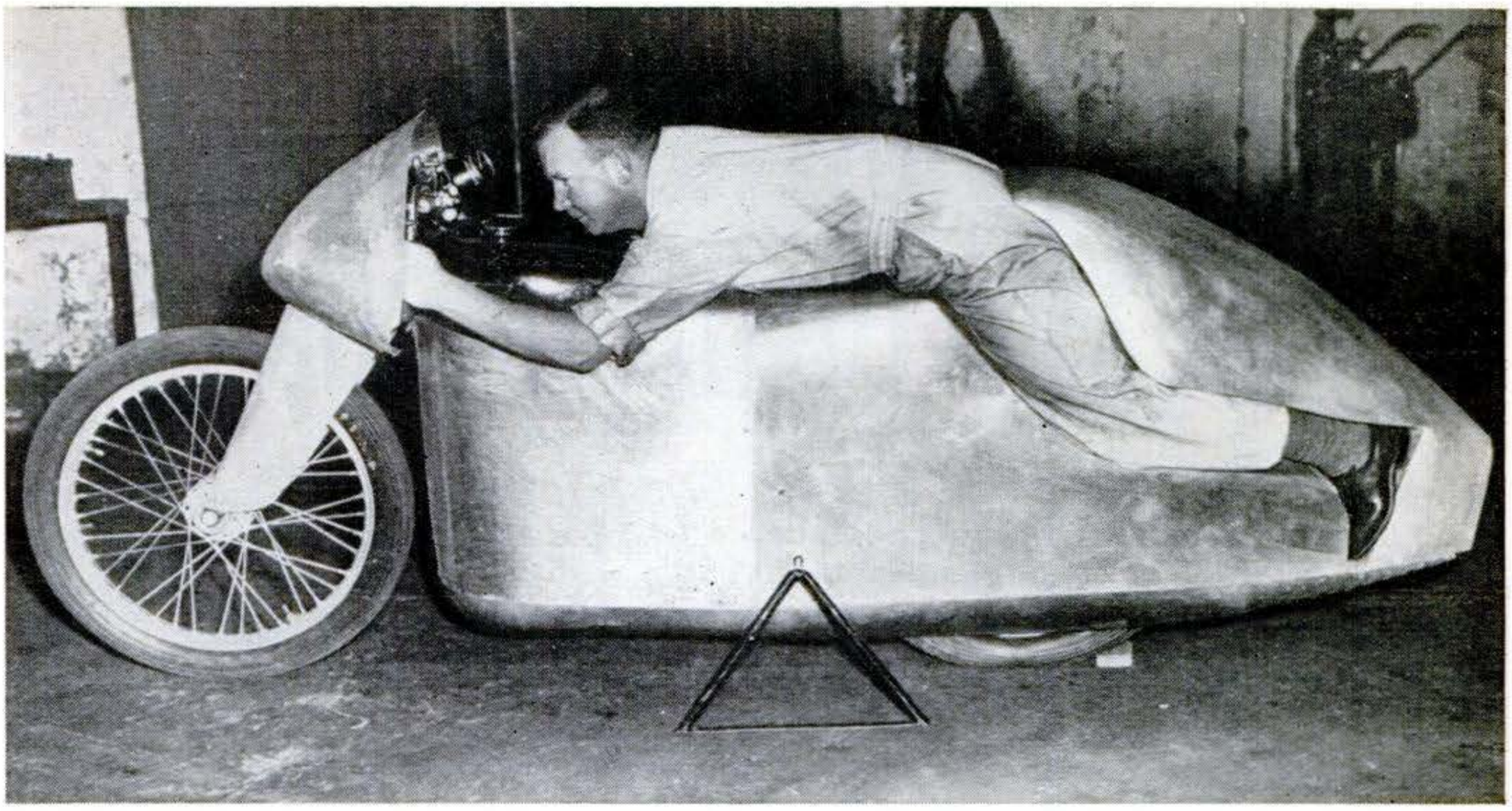


Prone Cyclist Seeks Speed

WHEN Victor Proctor mounts the motorcycle above, it fits him almost as closely as his clothes. For an attempt to break the world's speed record, pending as this was written, the South African racing driver has streamlined a two-cylinder Vincent machine. Lying prone to ride it, he tucks legs and feet into grooves in the metal fairing, reducing wind resistance to a minimum. Proctor holds the South African record at 136 m.p.h.

Nozzle Knob Adjusts Hose Spray

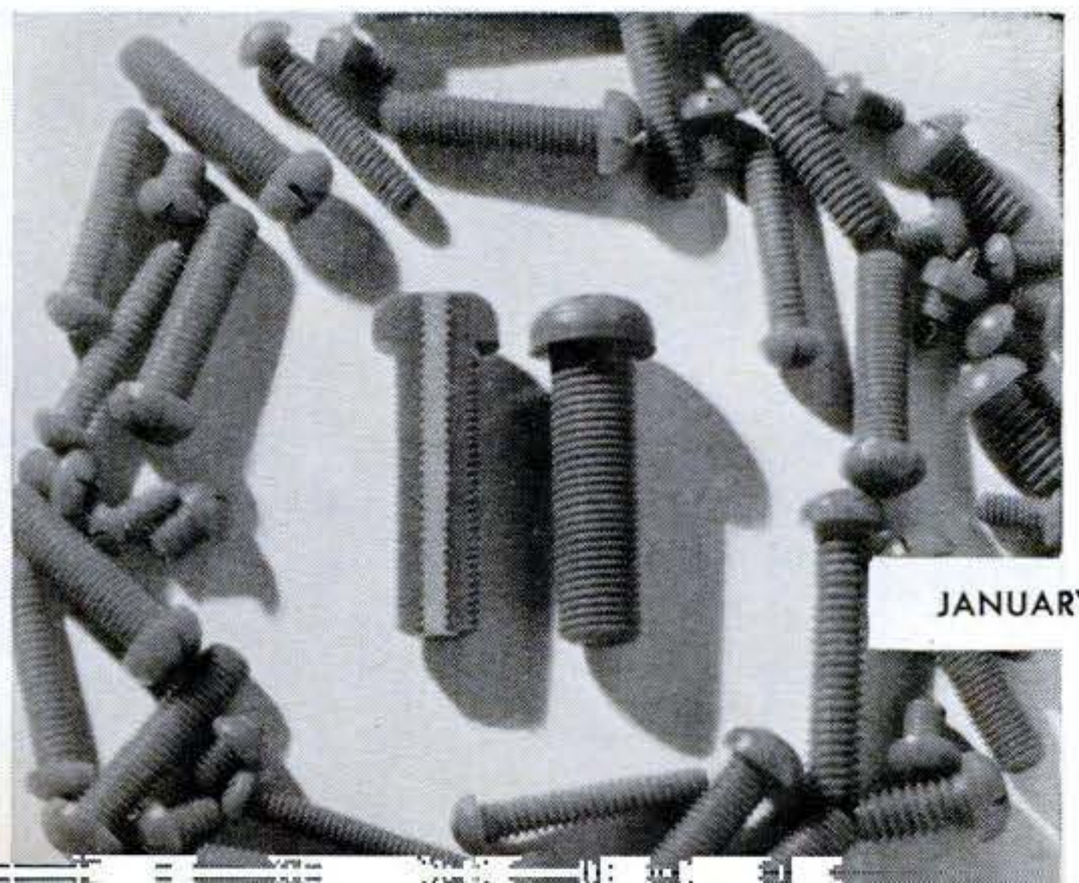
TWIRLING a knob on the garden-hose nozzle at left gives any of 27 varieties of spray, from fine mist to a full-pressure stream. A finger's touch also turns off the water at the nozzle. Said to be precision-built, durable, and corrosion-proof, the fingertip nozzle is offered by the Elkay Mfg. Co., of Beverly Hills, Calif.

Plastic Screws Are Strong, Too

MADE of plastic with metal cores, the new screws below combine advantages of each material. They eliminate insulating bushings and washers in electric switches and absorb vibrations in sound equipment. Metal cores give strength and contain the driving slots in the heads. Samples include one cut away to show the core. They're made by Forman Insulating Screw Corp., New York City.

Eye Shield Fitted to Torch

CLAMPED on an oxyacetylene welding torch, the eye shield below frees the user from wearing goggles, say two Shreveport, La., machinists who designed it. They say it's particularly useful to eyeglass wearers who need specially fitted goggles, or to beginners who must pause frequently to examine their work. The tinted lens is easily adjusted in a ball-and-socket mount.



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Problem: How to Keep The UN from Sneezing

Gentle, man-made breezes in a different kind of wind tunnel are helping science to clear up a high-level smoke problem.

By Bill Reiche

PS PHOTOS BY W. W. MORRIS

LET aviation's supersonic wind tunnels move over and make room for a low-speed cousin that is making a major and unique contribution to science's war against atmospheric pollution.

In its breezeway test chamber, miniature stacks belch smoke that attacks model "victim" buildings, while scientists play tricks with the aerodynamics involved when smoke and air currents get together.

Everyone knows smoke is a dirty nuisance that cuts property values and is injurious to health. It has been a critical community problem in St. Louis, Pittsburgh, and Los Angeles, and a matter of concern in scores of other cities.

Precise firing of boilers and the use of a uniform grade of coal can cut the objectionable fly ash to a minimum, and electrostatic precipitators can remove most of the remainder. What concerns the conscientious industrialist are the invisible companions of smoke—fumes and gas.

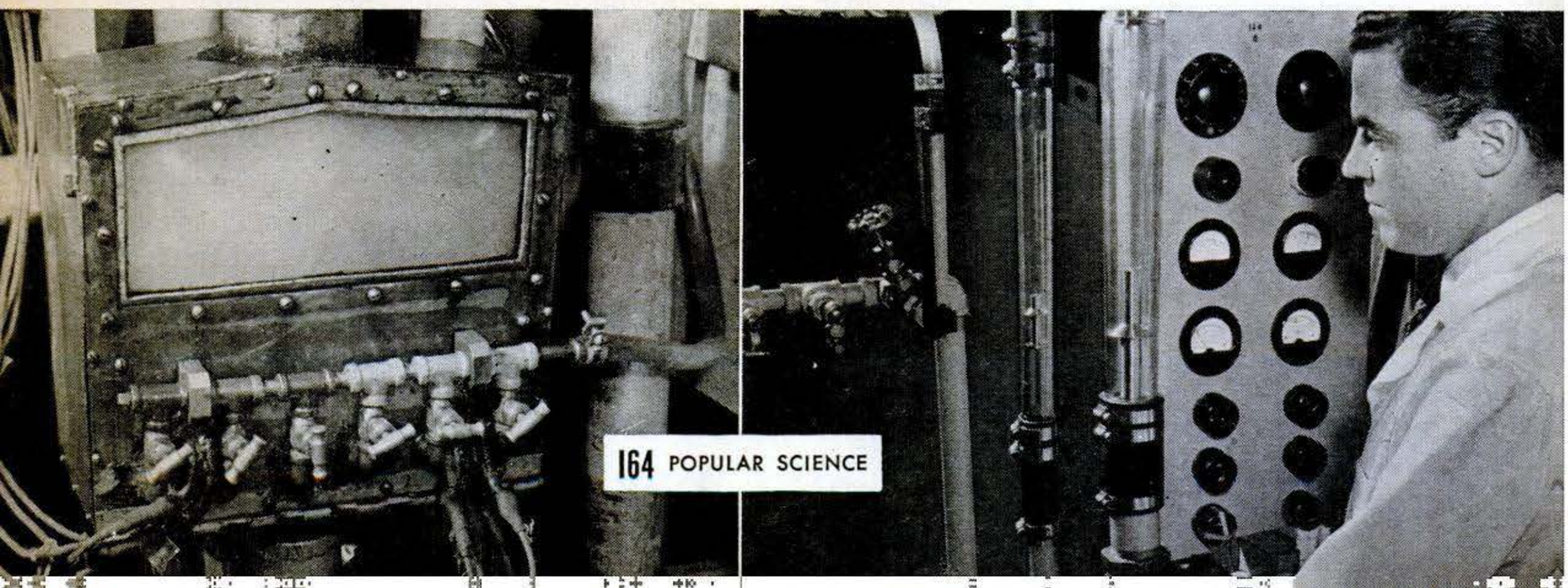
The problem is causing gray hair among the upper echelons of Consolidated Edison Co., the giant utility that provides New York City with electricity. It is conceded that the sulphur dioxide discharged as the result of coal-burning fires is neither pleasant nor healthful to breathe, especially when it reacts with moisture in the air. The 475-foot stacks of Con Edison's Waterside generating plant, on Manhattan's East Side, however, were considered tall enough to spew the gases harmlessly into the atmosphere. But that was before the United Nations erected its 540-foot Secretariat Building about 900 feet north. The new UN building is 100-percent air-conditioned, meaning that all its air is drawn in by fans at various levels.

The utility company was literally stinking up the premises of a distinguished international neighbor. Then the question was brought up of what the obnoxious gases and fumes might do to the handsome marble facing of the UN building. Con Edison quickly realized that it must step up its program of research into smoke and gas control.

It had already commissioned the Research Division of the College of Engineering at New York University to build a wind tunnel

Electrically-heated coils in the smoke generator, below, turn oil into a fog that resembles stack gas, except that, being cooler, it is less buoyant than the product of combustion.

Three flow meters of various sizes, below, precisely measure air going through tunnel's stacks, since velocity of "gas" in relation to that of wind is of vital importance in tests.



The smoke tunnel in operation. Models above show how the Waterside plant shrouds the neighboring UN building with "smoke" that would be drawn into its air-conditioning system.

Here are the buildings, seen from approximately the same direction as in the tunnel above. The new skyscraper may, at the moment picture was made, have been "inhaling" sulphur dioxide.

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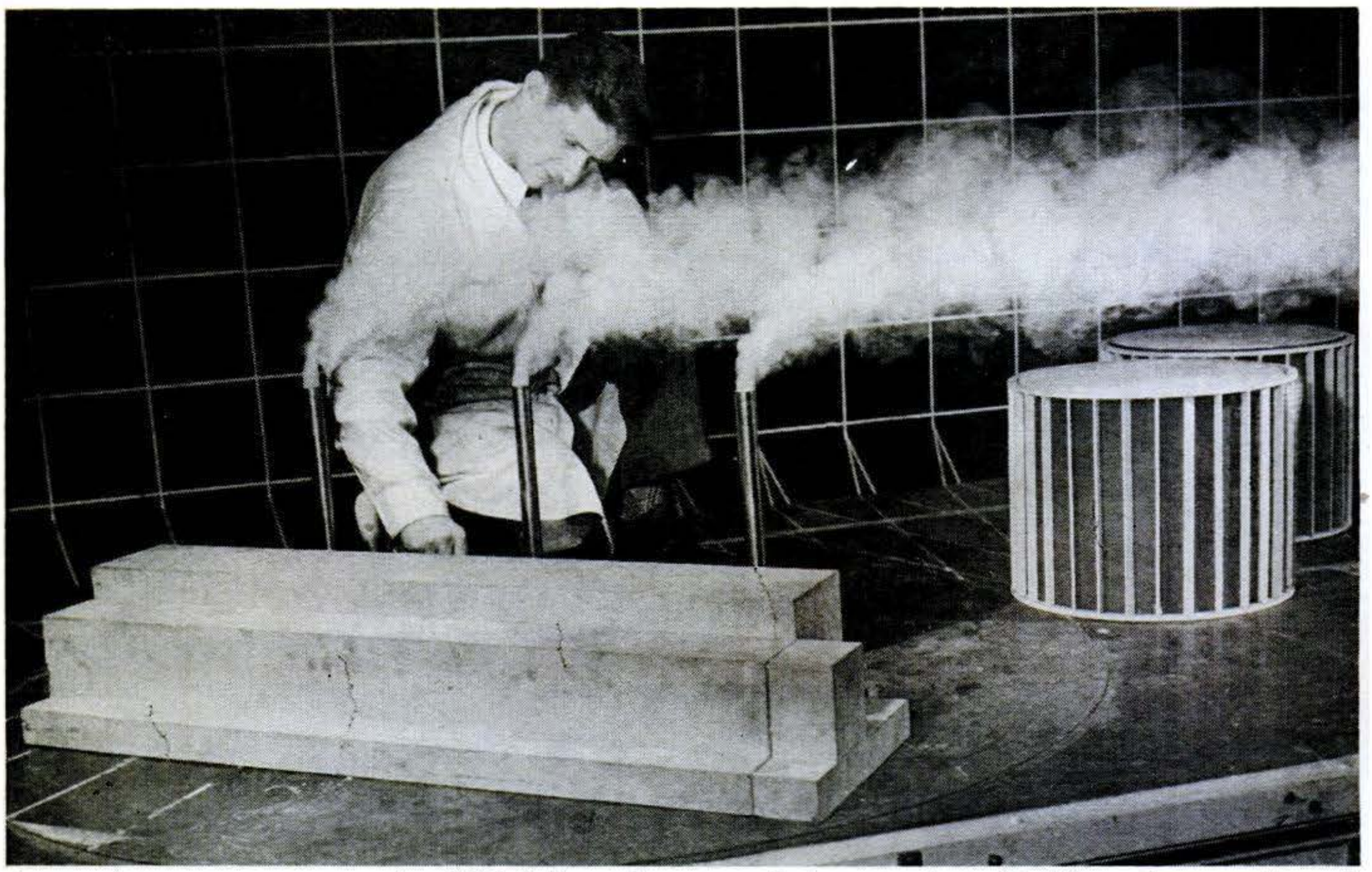

An engineer towers over the "300-ft." stacks of an experimental model of Con Edison's proposed Astoria plant. Building shape and stack location have important bearing on smoke trail.

in which the actual physical factors and major air movements could be duplicated. Into the breezeway, built by NYU scientists headed by Professor Gordon H. Strom, went a model of the UN edifice. The tunnel, more than 50 feet long, 3½ feet high, and 7 feet wide, has a useful working length of 27 feet. Winds up to 25 m.p.h. are created by a four-bladed, eight-foot propeller powered by a DC motor. A speed control on the motor, plus fine adjustment of the exhaust vents, make possible hairline control of the wind speed in the tunnel. A 10- by 13½-foot intake is covered with three layers of fine plastic screening to reduce the turbulence of the air.

First step was to install building models in the working area. These include a smoke-producing unit, the "target" unit affected, and any nearby structures that could affect the smoke trail. The smoking unit's stack is connected to a pipe leading from the blower and smoke generator. Three flow meters of different sizes measure precisely the amount of air sent through the stacks, a critical factor since the velocity of the smoke in the stack is an essential element in the problem.

In the fog generator, oil is fed into electrically heated coils and emerges through tiny orifices, only 15/1,000 of an inch in diameter, as an invisible vapor. On hitting the air, it condenses into a gray fog that makes a visible "gas" trail.

The models of the Waterside generating station and the UN building are in the same relative positions as their originals. A turntable on which they rest is adjusted to bring the wind out of the southwest, the prevailing direction. Then the smoke trail emerges. Even with a considerably higher stack velocity than wind velocity, the smoke travels far enough horizontally to hit the skyscraper and eddy about its upper third.

Outside the tunnel, cameras record the position of the smoke trail, which is brilliantly illuminated and "stopped" by six high-speed flash lamps operating at 1/10,000 of a second. The path of the smoke is measured against squares on the far wall, each representing 150 feet in the plane of the smoke.

To find out how much push would be necessary to clear the target building, the stack-to-wind velocity ratio is varied from one to one up to six or eight to one. The real UN building has almost unbroken glass sides and gray ends. The model is painted black, with light stripes indicating air-conditioning intakes. This enables scientists and cameras to localize the eddies of smoke whirling about the structure.

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There are a number of possible solutions to the problem. The stack height could be increased; the end of the stack could be modified to blow the smoke and gas higher; another fuel could be substituted for coal; or the offending sulphur dioxide could be washed out. Con Edison is interested in finding the most practical solution from the standpoint of initial cost, upkeep, and operating efficiency.

Removal of the sulphur dioxide by washing sounds like a sensible idea—except that it costs *$1 for every ton of coal burned.* This would represent a costly item, for the Waterside plant alone burns about 1,600,000 tons a year.

The NYU research originally involved a certain amount of crystal-gazing for its client, which is planning to erect a large generating station in Astoria, Queens, across the East River from Manhattan. In this instance, the problem is north winds in the winter time, since there is a large residential area south of the site.

Here the stack height is limited by the proximity of LaGuardia Field, with its heavy commercial air traffic. But, starting from scratch, there is another variable that can be used to advantage—the shape of the building.

Various structure shapes influence the smoke trails, since some create turbulence and eddies, while others do not. Location of stacks, on windward or leeward sides of the power plant, plays its part. It has been discovered that the ratio of stack to wind velocity may be reduced from 3 to 1 to 1 to 1, with equal results, if the building is designed with smoke control in mind.

New York University is also about to undertake research for the Atomic Energy Commission, which would like to know how atmospheric conditions will distribute radioactive waste gases from AEC stacks.

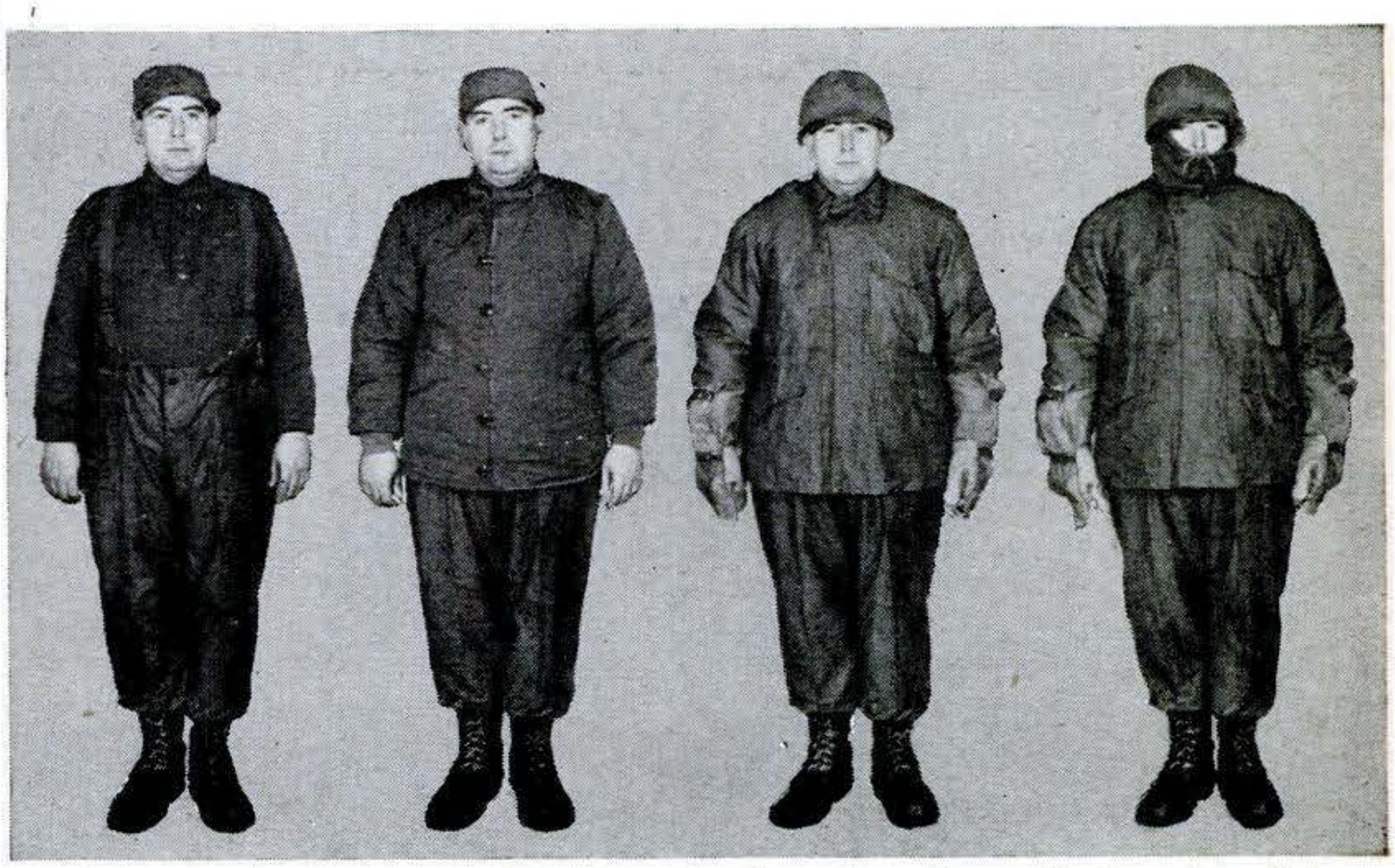
So far, the research group has learned a good deal about what happens to smoke and gas. It is now working on the matter of changing the velocity profile in the tunnel—varying the air speed at various levels. An attempt will also be made to devise an air stream that has different temperatures at different levels. Both are natural conditions, and will make the tests more realistic.

From this little wind tunnel may come knowledge that will mean cleaner air for more people. END

How a Soldier Keeps Warm and Dry in Korea

THE Army posed these pictures to show troops how to dress for combat in Korea's cold, wet mountains. The improved winter uniform, put on in layers, uses air pockets for insulation. Light, tough outer garments keep out wind and water; inner layers of wool hold body heat and soak up sweat. A new shoepac helps prevent trenchfoot.

Soldier puts heavy felt insole in shoepac worn over two pairs of wool socks.



Under cotton field trousers (above) are underwear, shirt, trousers, sweater.

Pile jacket buttons close to neck. Cotton field cap has wool-lined ear flaps.

Field jacket of water-repellant, wind-resistant cloth completes outer layer.

Jacket hood buttons under helmet. Wool-lined mitten has "trigger" finger.

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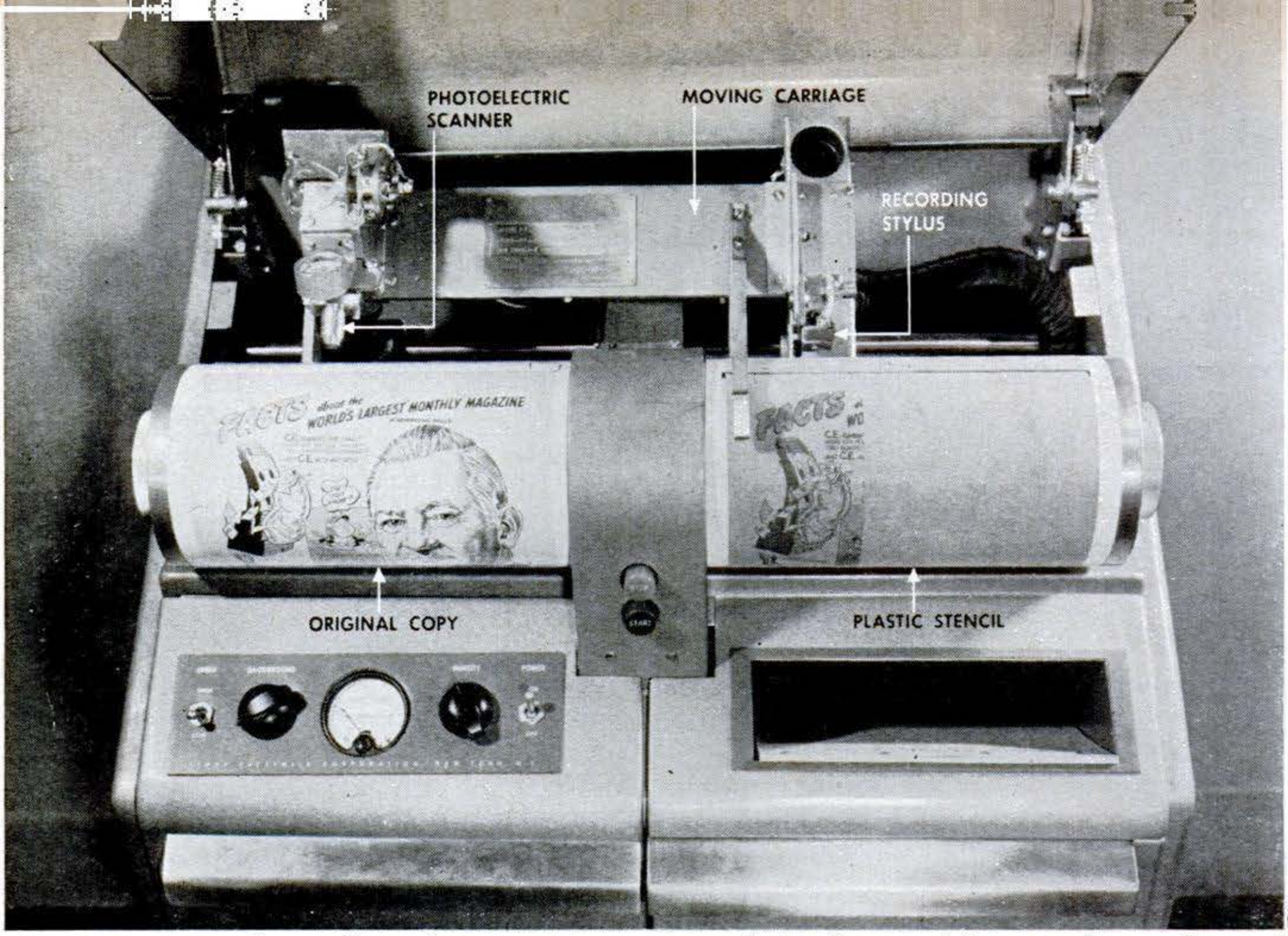

Called Stenafax, the machine above cuts stencils electronically. When the photoelectric scanner "sees" black on the original copy wound around the drum at left, it sends out electrical pulses, causing a stylus to perforate the plastic stencil wrapped around the drum at right.

Fax Machine Cuts Mimeograph Stencil

THIS new electronic facsimile machine makes exact copies of letters or drawings on stencils so they can later be mimeographed. Up to now, stencils could be cut only by a typewriter or a hand stylus.

The machine, called Stenafax, has two revolving drums that turn at exactly the same speed. The material to be copied is wrapped around one cylinder, and the stencil to be cut, a plastic sheet, is wrapped around the other. Then a photoelectric cell, moving slowly along the first drum on a carriage, scans the original material at the rate of 144 lines to the inch. When the scanner "sees" black, it sends an electrical impulse to a recording stylus that tracks on the second drum. The electrical charge, arcing between the stylus and the metal drum under the plastic sheet, produces a spark that burns a pinpoint hole into the plastic to form a black dot. The number of these dots provide gradations all the way from white, where no dots appear, to black, where they are packed closely together.

Made by the Times Facsimile Corp., of New York City, the machine cuts a stencil in six minutes. Over 10,000 mimeographed copies can be made from one plastic sheet.

To attach stencil to the receiving drum, bottom of sheet is first hooked into a slot, as below, then sheet is wound around cylinder. Opening in front of drum holds extra stencils.

Recording stylus is fine tungsten wire, 4/1,000 in. thick, that sends spark into plastic stencil whenever scanner "sees" black. Sparks burn holes into plastic, can make 6,000 a second.

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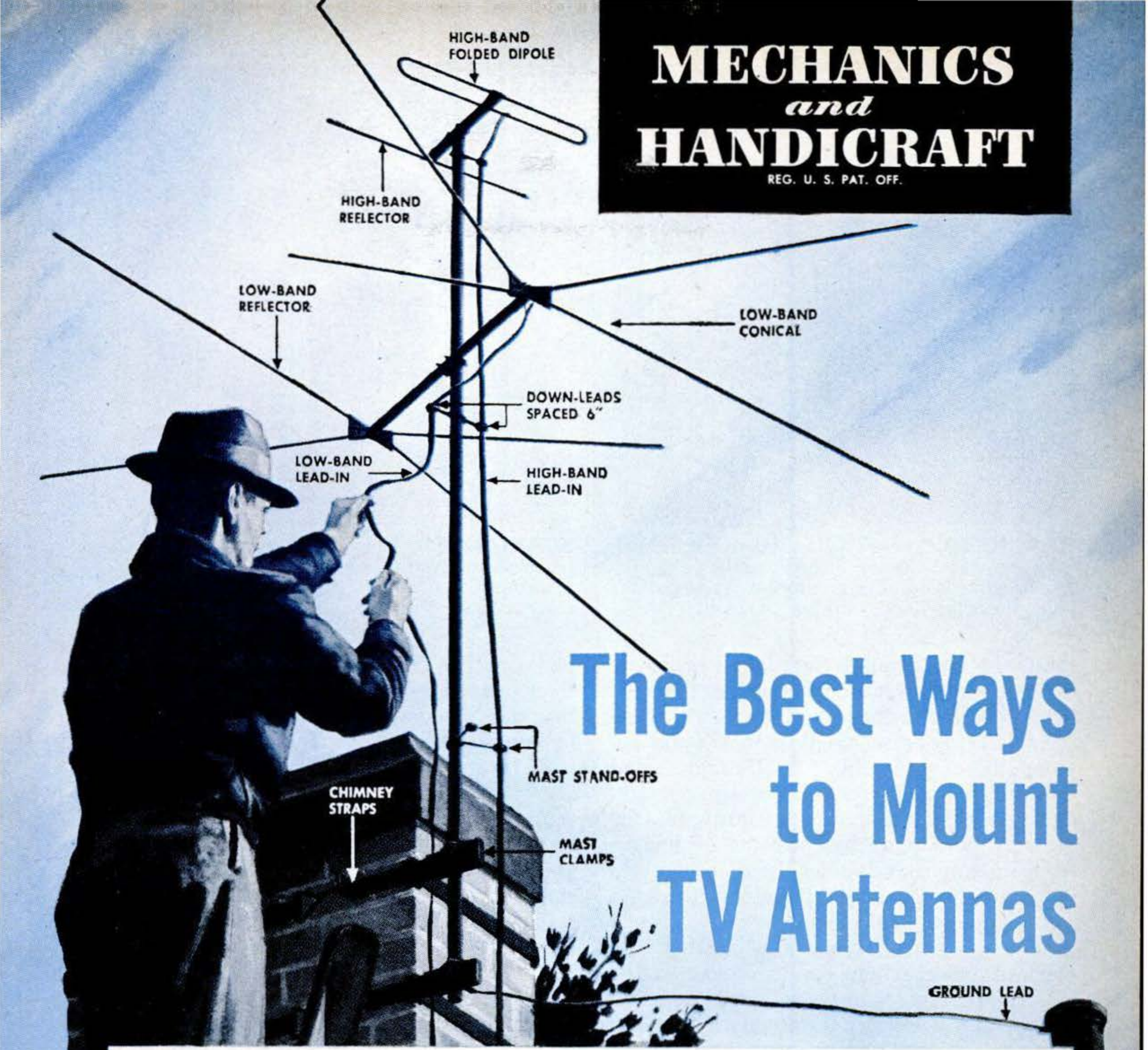


The Best Ways to Mount TV Antennas

How long you keep getting a good picture depends on how you put up that aluminum signal catcher.

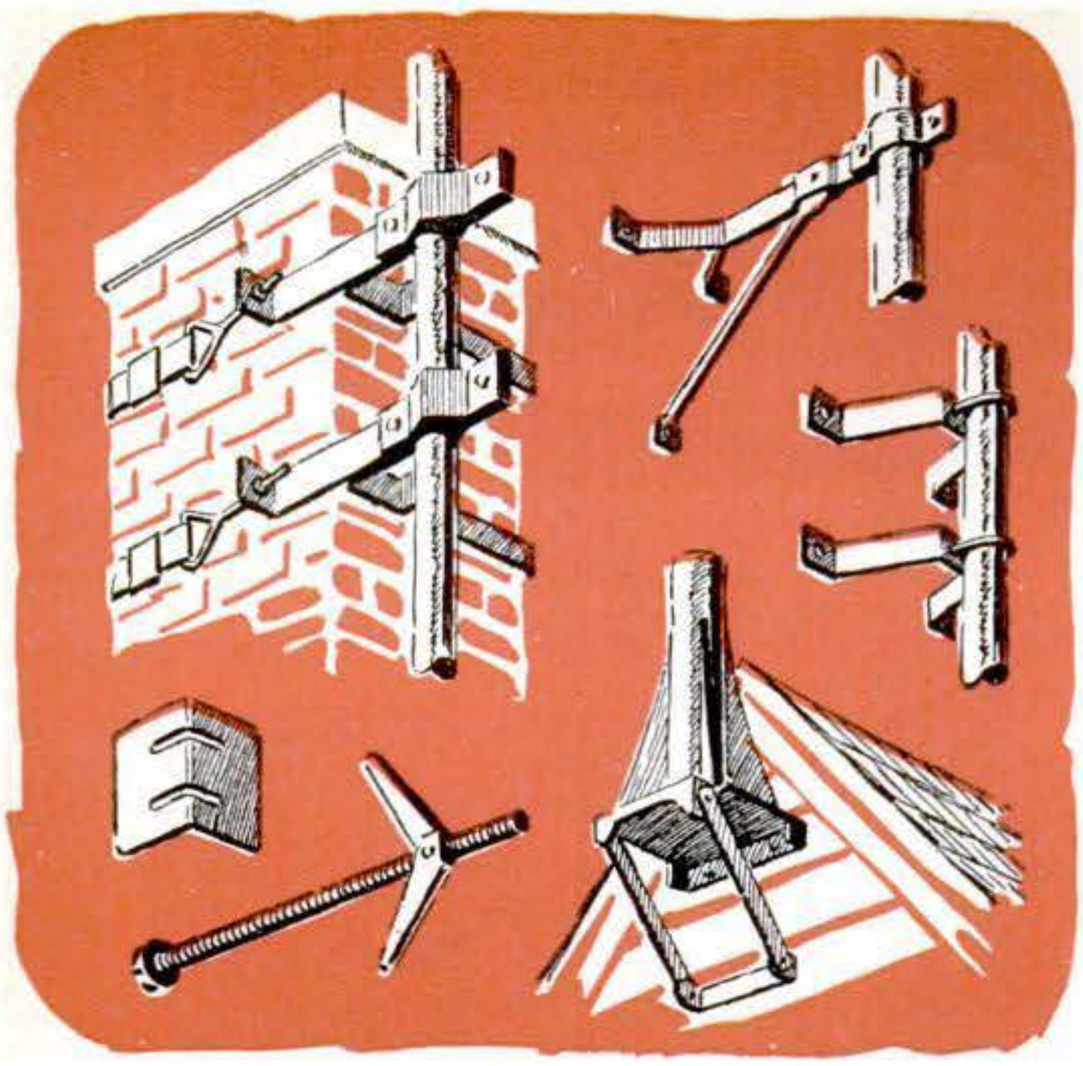
By Norman L. Chalfin

DRAWINGS BY RAY PIOCH

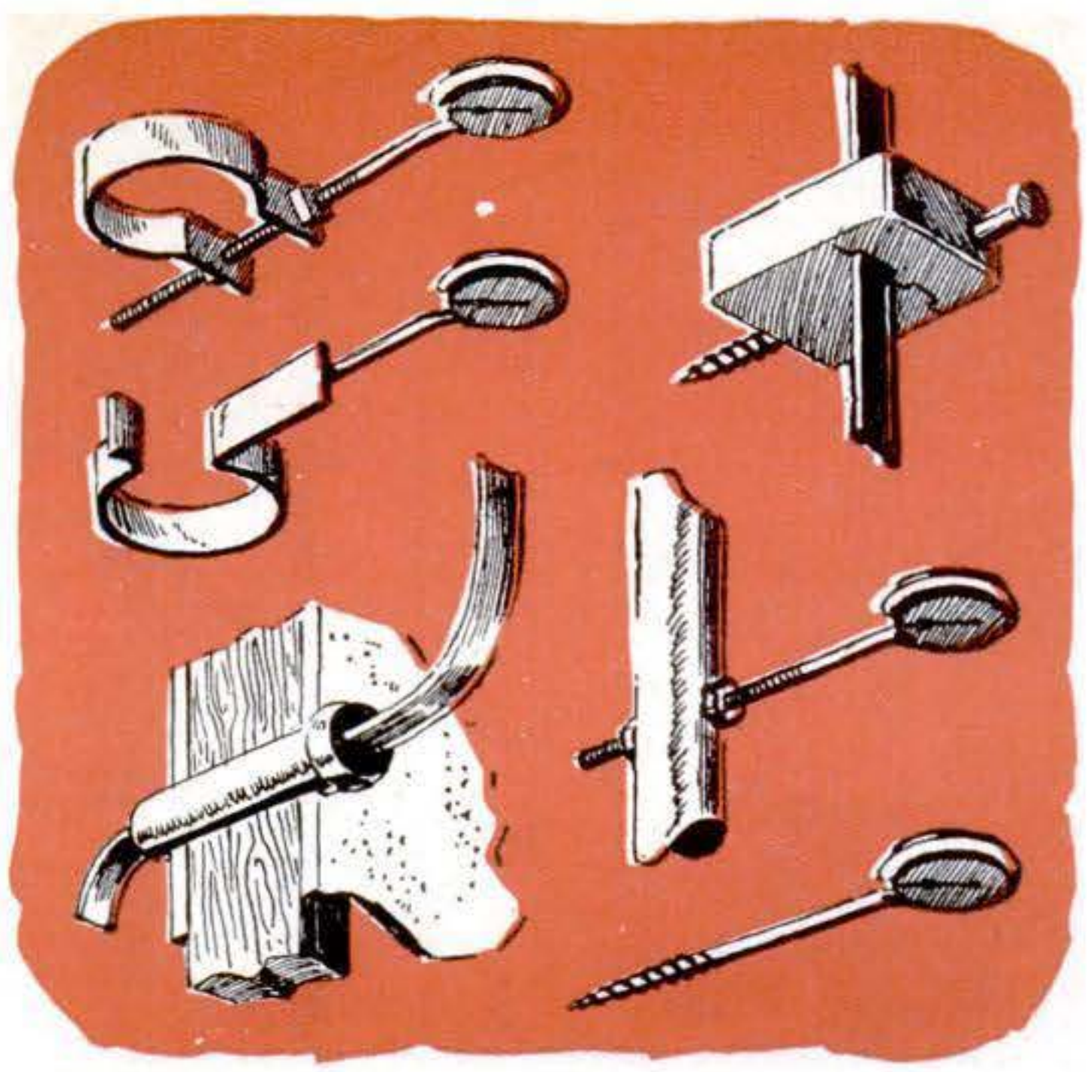
DRIVE down any street in old television territory, and you're likely to see antennas that look like dead trees. Some lean wearily and dangerously, some have bent or broken arms, and many swing and sway in ways that make clear reception almost miraculous. Passersby have been imperiled, architecture has been marred, and the eyes of TV viewers have been strained—for no reason other than poor installation.

TV antennas are not so very heavy or difficult to mount properly. Brackets galore are available for attaching them firmly to flat or sloping roofs, walls, or chimneys. Properly used, these attachments should hold a mast vertical for many years. Guy wires and lead-in ribbons can easily be kept from dangling like forgotten clotheslines. In fact, anybody able to make roof and gutter repairs can also put up a television antenna securely.

Wind and ice are the saboteurs that have wrecked many antennas. If a TV assembly sways even slightly in the breeze, the picture is affected; if a gale



BRACKETS. There's a size and style for every roof or wall. Corner guards under chimney straps protect brick and mortar. Toggle bolts hold best in wood, stucco, or similar walls.



STAND-OFFS. They keep down-lead spaced off masts and walls, hold it taut, bend it smoothly around corners. To bring lead into house, use porcelain feed-throughs (above, lower left).

twists the rods around, the picture may fade out completely. Ice collecting on the rods increases the surface that must withstand the wind's assaults and thus makes the antenna more vulnerable. A 50-m.p.h. wind applies 10 lb. of pressure per square foot, and when the wind rises to 100 m.p.h. the pressure per square foot soars to 40 lb. An ice formation that doubles the diameter of a rod may also increase the weight of a solid rod 150 percent and a hollow rod as much as 1,000 percent. Hence, the weather that you can expect where you live is one of the most important factors to consider when you put up a television antenna.

Why Make Your Own?

You can usually buy an antenna system as cheaply as you can make your own. If put where the TV signals can reach them, these antennas will generally do what the manufacturers say they will do. But they will not *stay* there unless they are supported adequately. And before you tackle the job, it's a good plan to check on local legal requirements from a building inspector and the fire department (which is sometimes concerned with guy-wire obstructions as well as lightning hazards).

The commonly used antenna systems are available in knockdown form, and only a few tools are needed to assemble them. Most of these kits include a 5′ or 8′ mast, usually a hollow aluminum or dural rod. Such a tube will withstand considerable bad weather if its walls are at least .040″ thick and it is 1¼″ in diameter. If more height is needed, 5′ extension lengths can be purchased.

Wall Clamps and Brackets

Antennas having only a few arms on a short mast often can be attached to brick walls or roof parapets with U clamps or stand-off brackets. But these should be screwed to the wall. Holes can be made in the bricks—the mortar bond should not be relied on, because rain may loosen it—with a star drill, lead anchors inserted, and screws threaded into these. There should be at least two such brackets in every case and one every 3′ if the mast extends down the wall more than 3′.

Similar brackets can be used to hold a small antenna to the face of a gable end of a wood-sheathed house. This is often simpler than mounting the rig on the roof. But the brackets should be placed close to the pinnacle and attached firmly to the wood. Lag screws rather than ordinary wood screws can be used but expansion or toggle bolts are better.

Don't Wreck Your Chimney!

Chimneys are convenient things to put antennas on. But if the mortar is cracked or bricks are loose, a chimney should not be used unless it is first made solid enough to withstand the additional stresses that an antenna will place on it. Punching holes in

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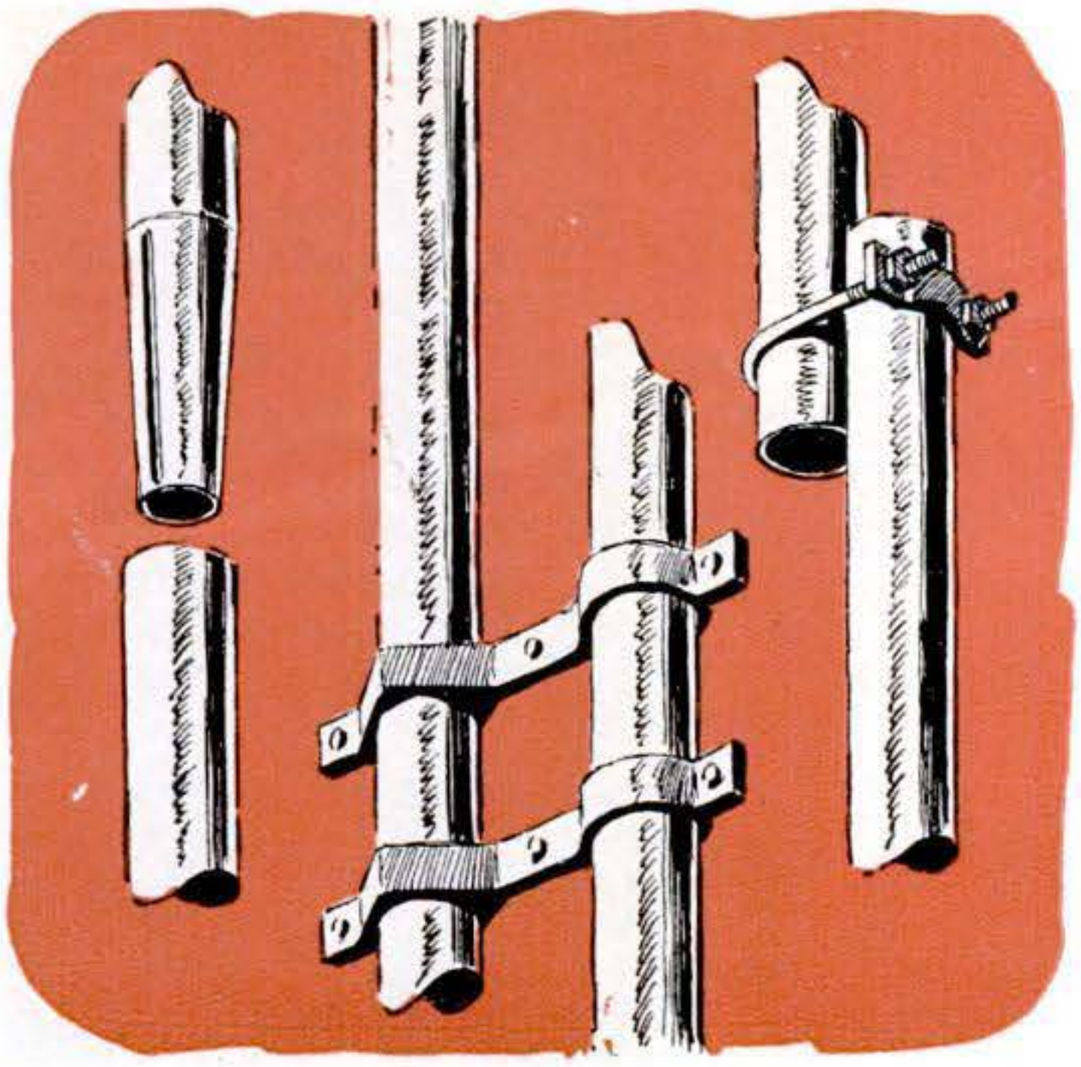
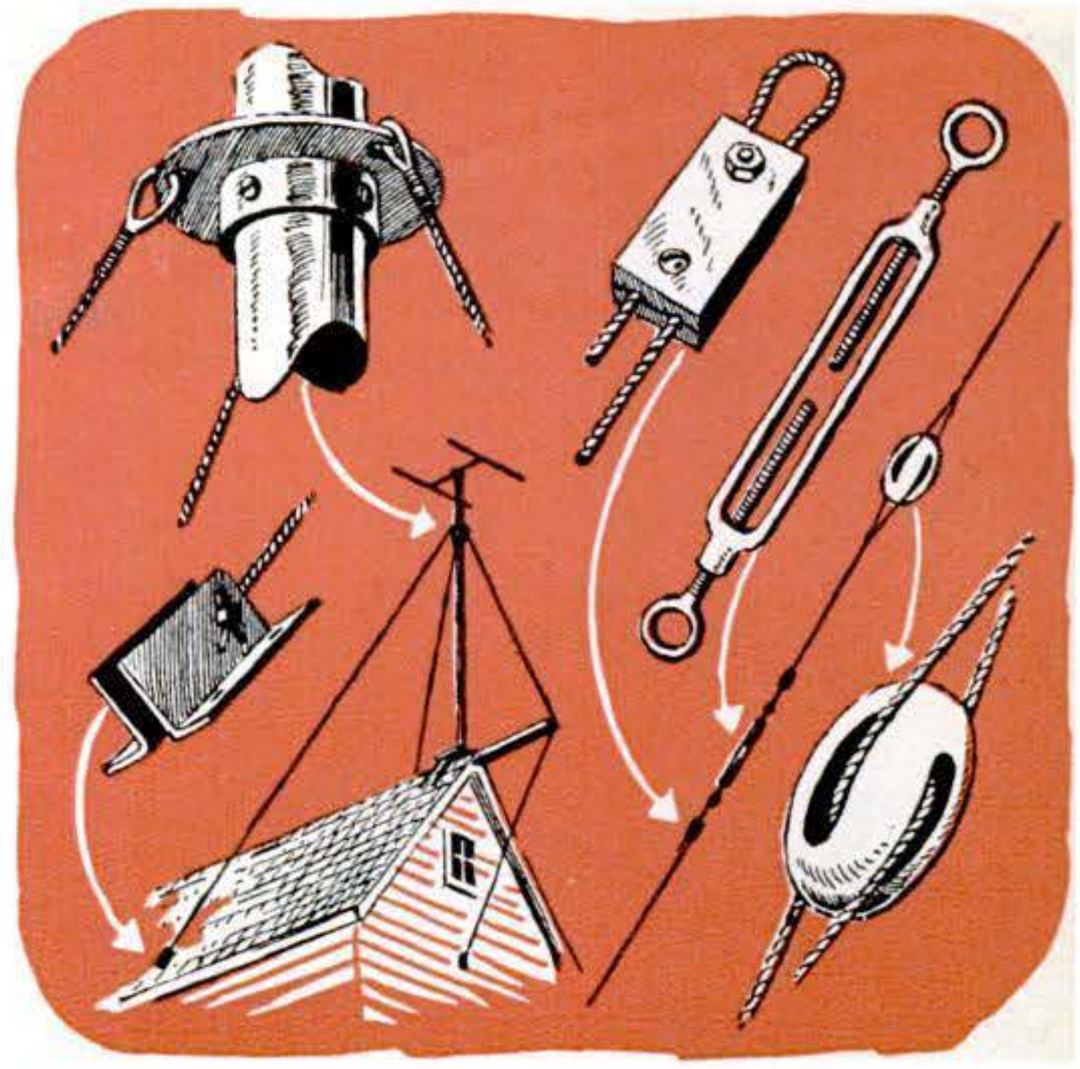


MAST CLAMPS. To gain height you can stack mast sections one above the other. Some types have nesting ends; others may be joined by clamps made to fit standard mast diameters.



GUYS. Support high antennas with three or four equally spaced, firmly anchored guy wires. Build out extra anchor point on roof if needed. Use strain insulators to break long wires.

a chimney, moreover, is likely to damage it. Straps with pipe clamps attached can be used, but the strap must be chosen and put on carefully. One that is too narrow may cut into the mortar, damage the chimney, and leave the antenna wobbly. A strap that is too thin may snap and let the mast fall on someone's noggin. Galvanized steel straps about 1″ wide have proved satisfactory in many cases—but inadequate, improvised straps have caused much trouble.

Never support an antenna by strapping its mast to another post or pipe structure with whatever you happen to have handy. Straps have a tendency to rust and stretch—and then slip. A pipe-clamp type of mounting unit in which the pressure is maintained by screw threads will usually hold heavy metal parts together much more securely.

Flat and Sloping Roofs

Flat roofs such as you find on apartment houses usually consist of several layers of material through which it is difficult to drive bolts, nails, or screws without letting water seep in. Setting the mast on a heavy wooden or metal base and guying it carefully may reduce the number of holes needed. Packing roofing compound around every screw that goes into a roof or frame wall will help to keep leaks from starting.

Several types of mast mountings are now available for installations on sloped roofs. Choose one that you know you can put up without damaging your roof or impairing the appearance of your home, if you must place your antenna on such a roof. Then guy it in at least three directions, even if this means that you must put an outrigger support at one end of the roof for a guy wire.

No mast should be anywhere near a power line. The minimum distance between an antenna and a power line should be at least eight feet more than the height of the mast. Every mast should also be grounded. Number 6 or 8 wire securely connected from the mast to a water pipe will serve. This does not eliminate the need for a lightning arrester in the lead-in itself.

How to Guy Antennas

Every antenna more than 8′ or 10′ high should be guyed. The guy wires should be non-corrosive and of 300-lb. test strength, run if possible in four directions at right angles to each other, and be at an angle of about 30° from the mast. They should be attached to the upright pole with guy rings, and turnbuckles should be placed near the base ends. The tension then can be adjusted if the changes in the weather make this necessary. Too much tension may buckle a mast, so this must be done carefully.

On a tall, base-supported pole there should be a set of guy rings 5′ from the bottom and another set for every 8′ or 10′ of mast above. Ball-bearing rotatable guy rings are available for rotating masts.

When the guy wires are longer than the

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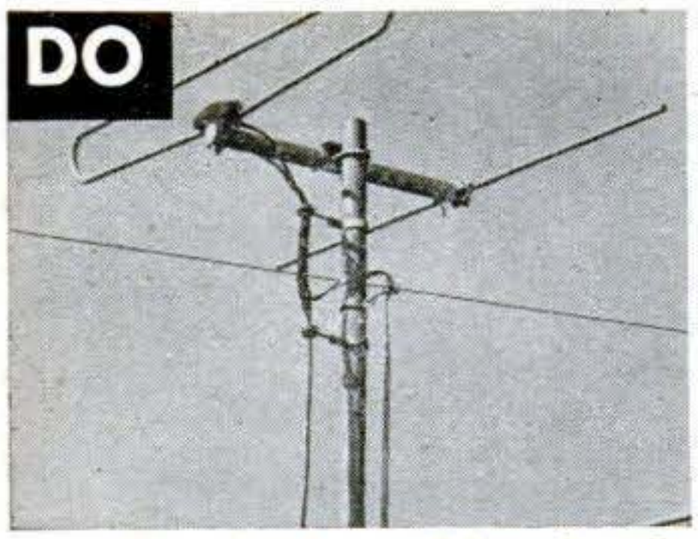
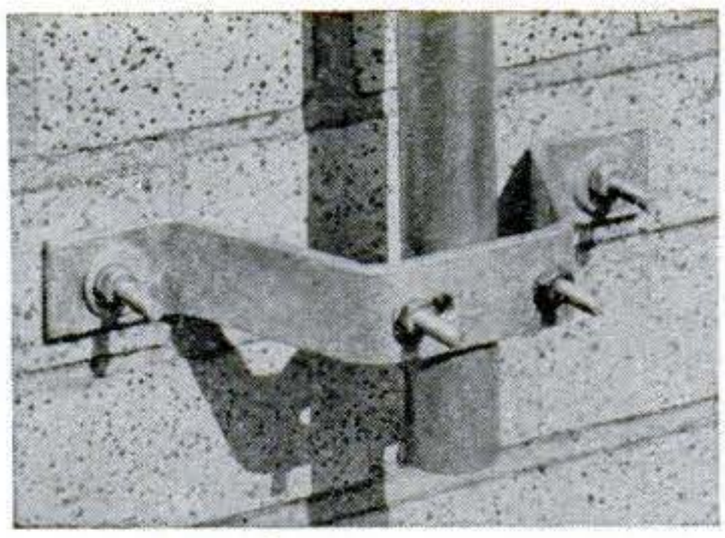
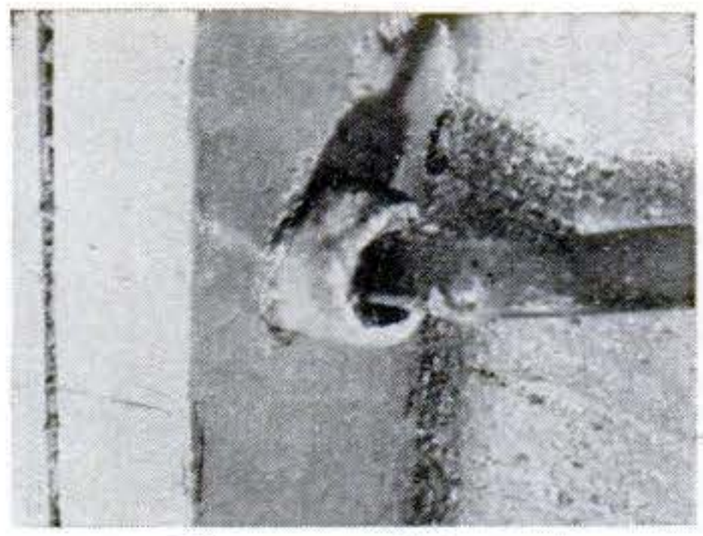


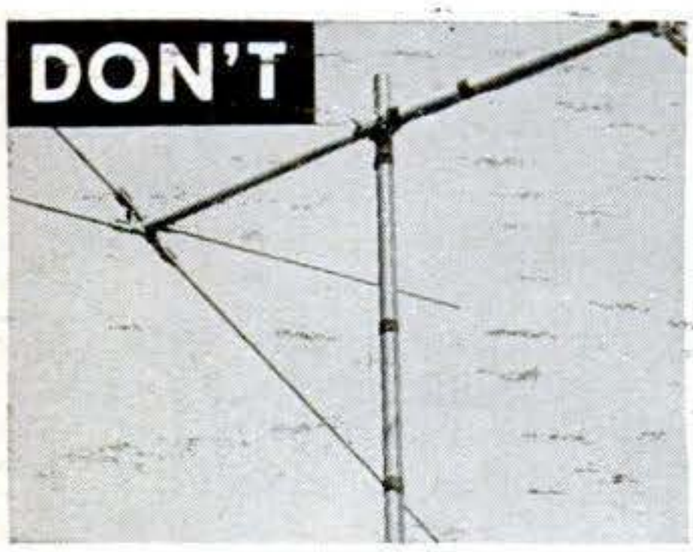
. . . Keep high- and low-band lead-ins 6" apart and on opposite sides of pole.



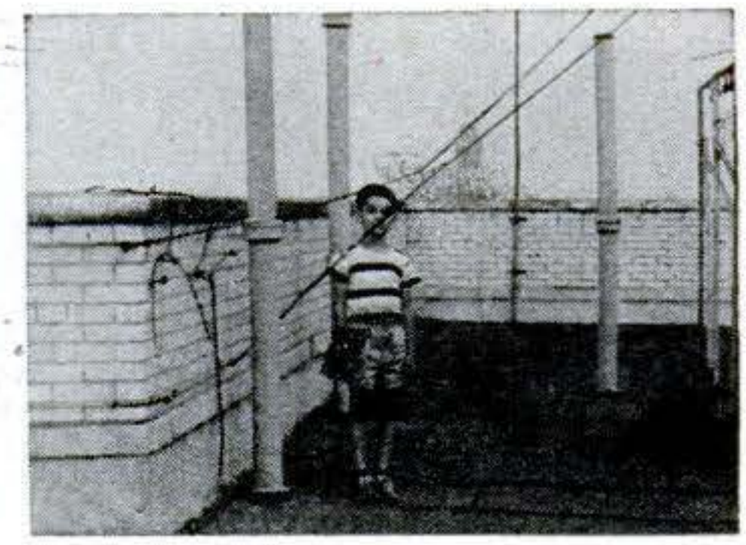
. . . Attach your mast mount to brick, not mortar. Use lead anchors in holes in bricks.



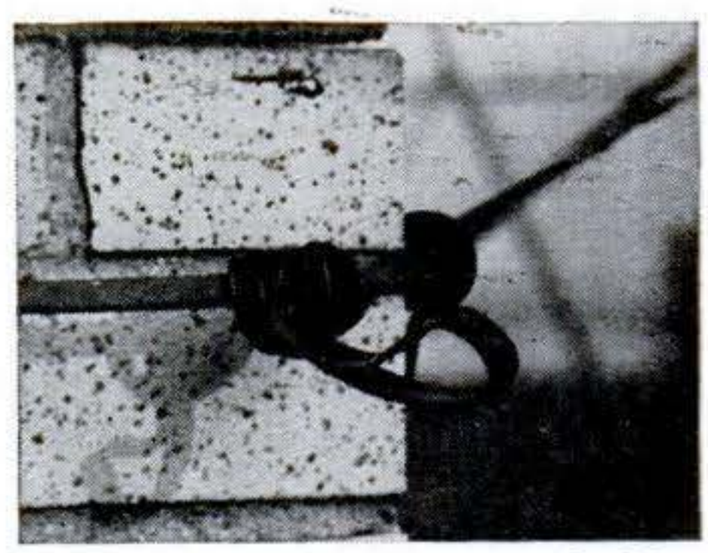
. . . Use porcelain tubes to bring lead-in through wall. And keep it short.



. . . Fasten a lead-in tightly to a mast this way. Use stand-offs.



. . . Place guy wires where children — or firemen — might run into them.



. . . Leave loops or coils like this in the lead-in near insulators.

length of the antenna's arms from tip to tip, strain insulators should be inserted. None of the lengths between these insulators should equal the over-all length of dipoles cut for the channels you wish to receive (PS, Sept. '50, p. 237) or multiples of those lengths. Guy wires of such lengths become parasitic and reduce an antenna's efficiency.

Attaching the Lead-In

Antenna assemblies often include 60 feet or so of 300-ohm lead-in ribbon. This is the type most commonly used, although a shielded type is better if you live in a "noisy" area—that is, one where considerable electrical disturbance is encountered. When the 300-ohm ribbon must be spliced, care should be taken to preserve the distance between the wires.

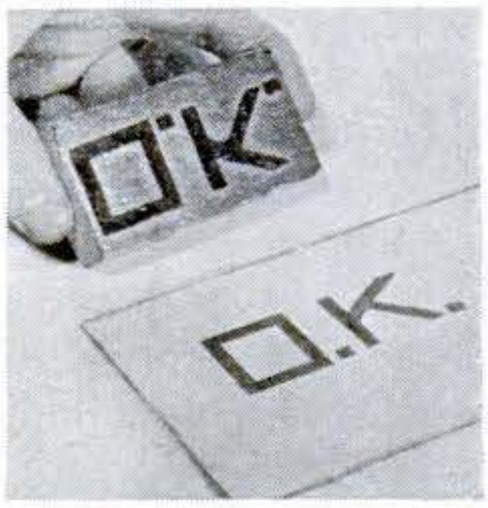
The best way to attach these wires to your antenna is to solder U- or ring-type lugs to the ends and bolt them to the terminals, using lock washers. Keeping the lead-in at least 3" away from the mast that supports the antenna will reduce the danger of losing signal strength. This can be done quite easily with cheap stand-off insulators.

The lead-in should be kept as short and straight as possible. Loops and coils in the ribbon can weaken your picture and put ghosts in it. When the ribbon is brought around corners, it should be done with stand-off brackets. And when it runs for any considerable distance it should be anchored often enough to prevent it from flapping in the wind, fluttering the picture.

TV receivers, like people, work best when they are well fed—and how well your set is fed depends to a large extent on how well your antenna is put up and connected to it. Doing the job right will improve the looks of both the pictures on your screen and the exterior of your home. END

Next month* Popular Science *will tell you what you should know about TV boosters.

How to Make Your Own Rubber Stamps



LARGE block letters, numerals, or symbols for stamping signs and placards may be easily made from a discarded inner tube. Draw or trace the letters on pieces of the tubing and cut them out with a sharp razor blade, using a ruler as a guide. Cement the letters to a wood block in reverse order and face down, as shown, and ink with a stamp pad.

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When closed (above), desk takes up but little room. It's only 8″ deep. Yet, when it's open (right), there is a big writing area and roomy compartments for paper, envelopes, and other writing supplies.

Wall Desk Built in Half a Day

A handyman's answer to the high cost of furnishing a home comfortably.

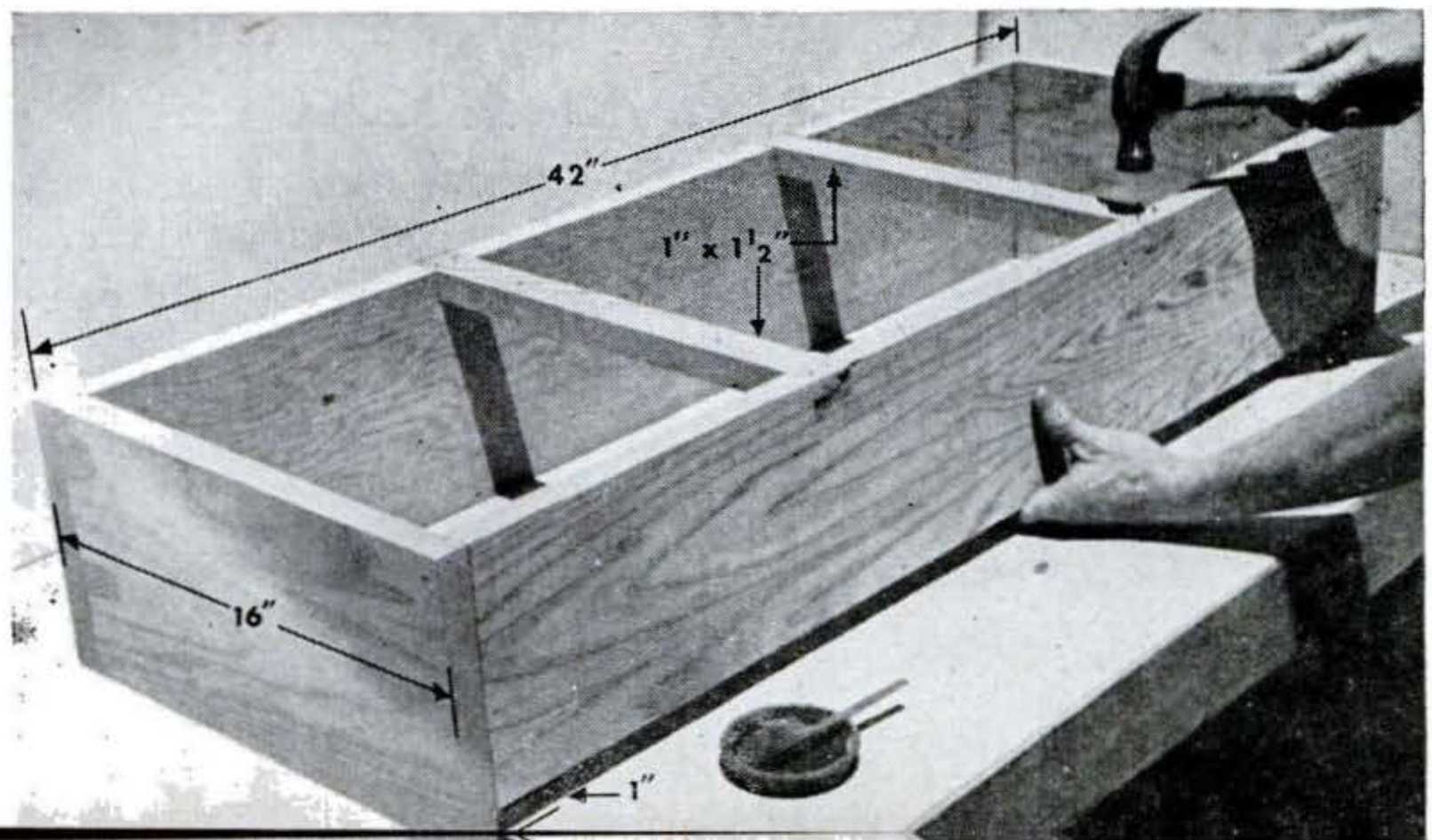
By Paul Corey

MY DAUGHTER wanted a place to do her homework in our living room. So I decided to build a wall desk as simple in design and as economical in cost and use of tools as possible. The photos show you how it looks, and it cost me only $3.80 and an afternoon's work.

For lumber I bought four 1″ by 8″ undressed redwood boards 6′ long. Boards of this length were easy to bring home in the car. After smoothing the boards with plane and sandpaper—the hardest part of the whole job—they still were almost 1″ thick.

The standard 25/32″ thickness of mill-dressed lumber is all right for this desk. But I went to the extra work of dressing the stock myself because I like the looks of the heavier boards.

With more tools and time, you could put a desk like this together with more elaborate corner joints. But I decided on simple butt joints held together with nails and glue, and they have proved perfectly adequate for



Simple construction is shown here. Mounting strips on back of desk are placed where they match wall studs. One inch was ripped off bottom board to make room for the hinged front.

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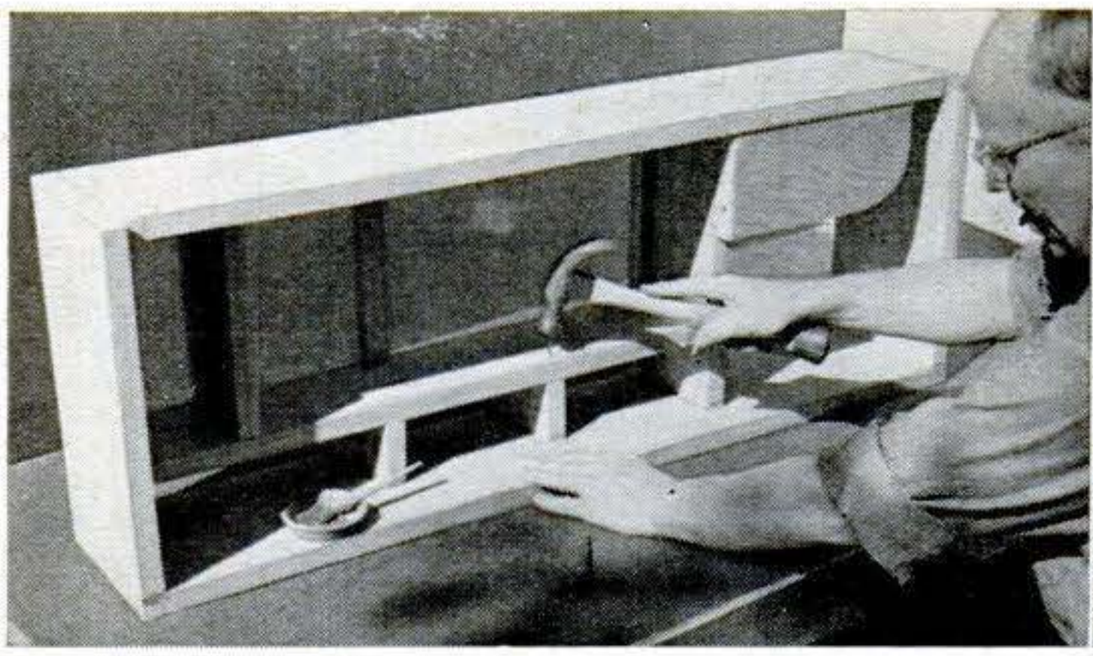
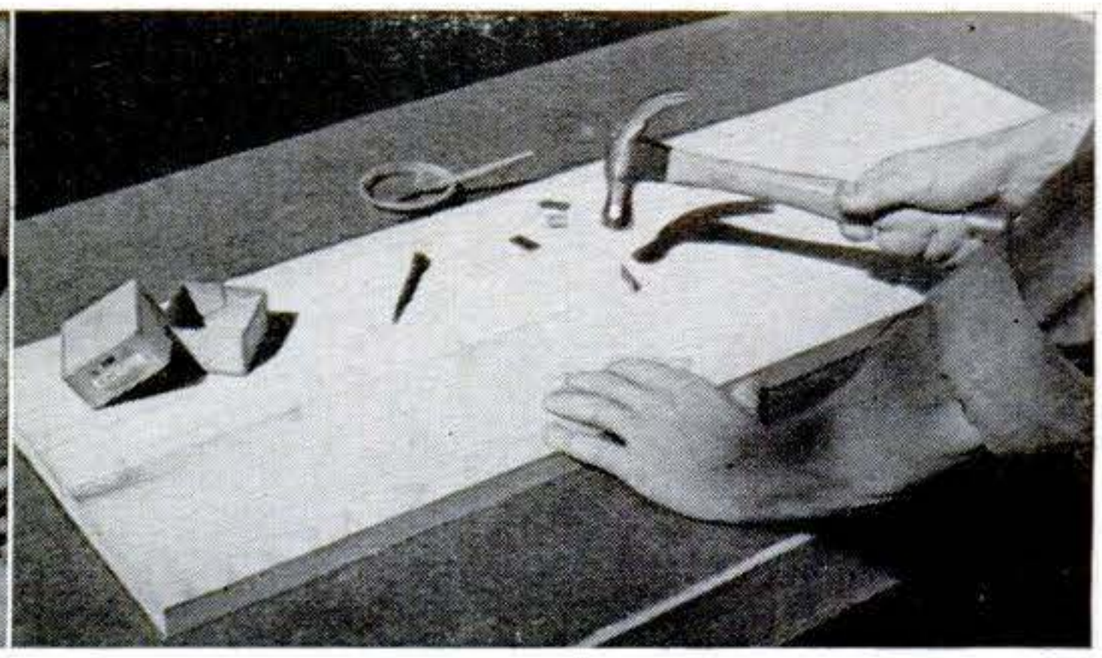


Put in partitions and compartments for stationery to suit yourself. Fasten them with nails and glue. Desk has no back, since the wall serves as a back when the desk is mounted.



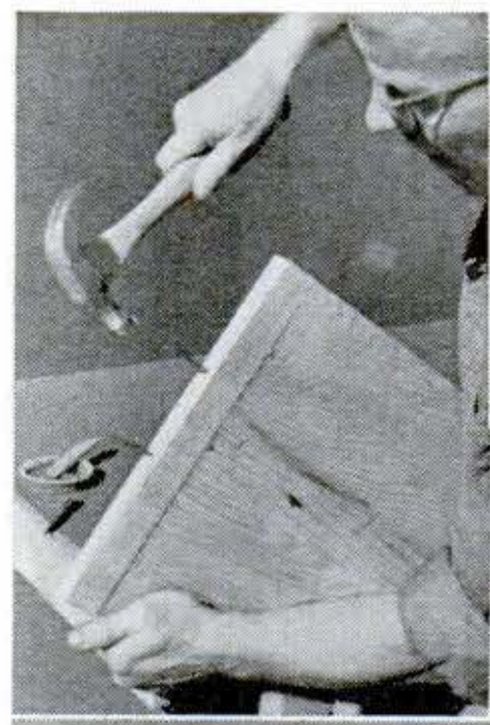
Boards to make lid were cut 3″ short to allow for stiffeners at each end (below). Corrugated fasteners and glue were used to hold boards together. Fasteners were countersunk.

our purposes. A continuous or piano hinge fastens the desk lid to the desk bottom. (You may find it under either name.)

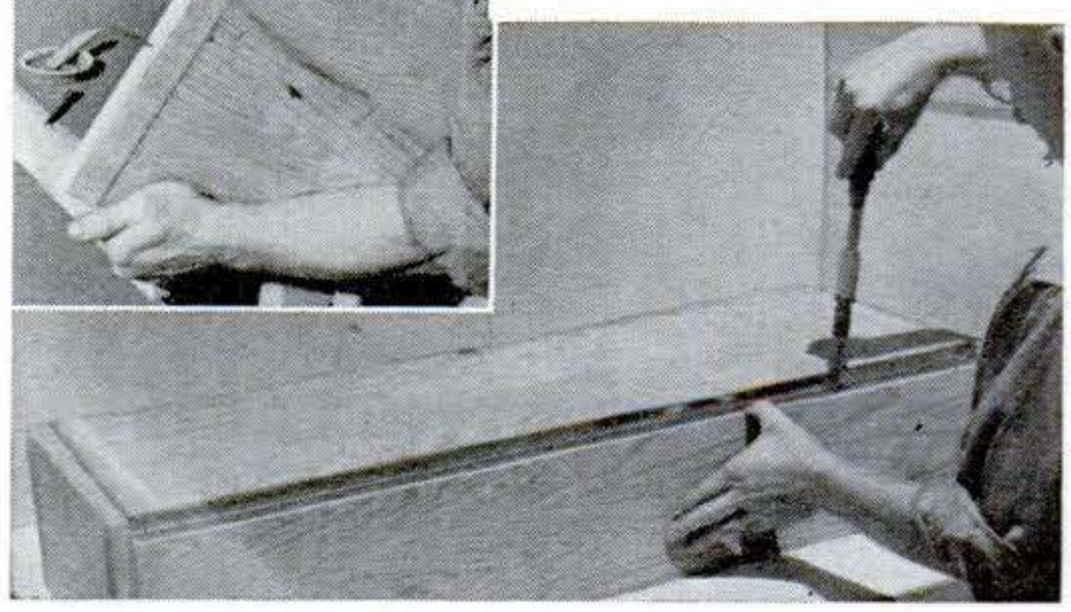
The desk lid is held shut with friction bullet catches—one 3″ in from each end. A finger notch in the center makes for easy opening.

To support the desk lid firmly for writing, I added stay hinges at each end. These fold up out of sight inside the desk when the lid is closed.

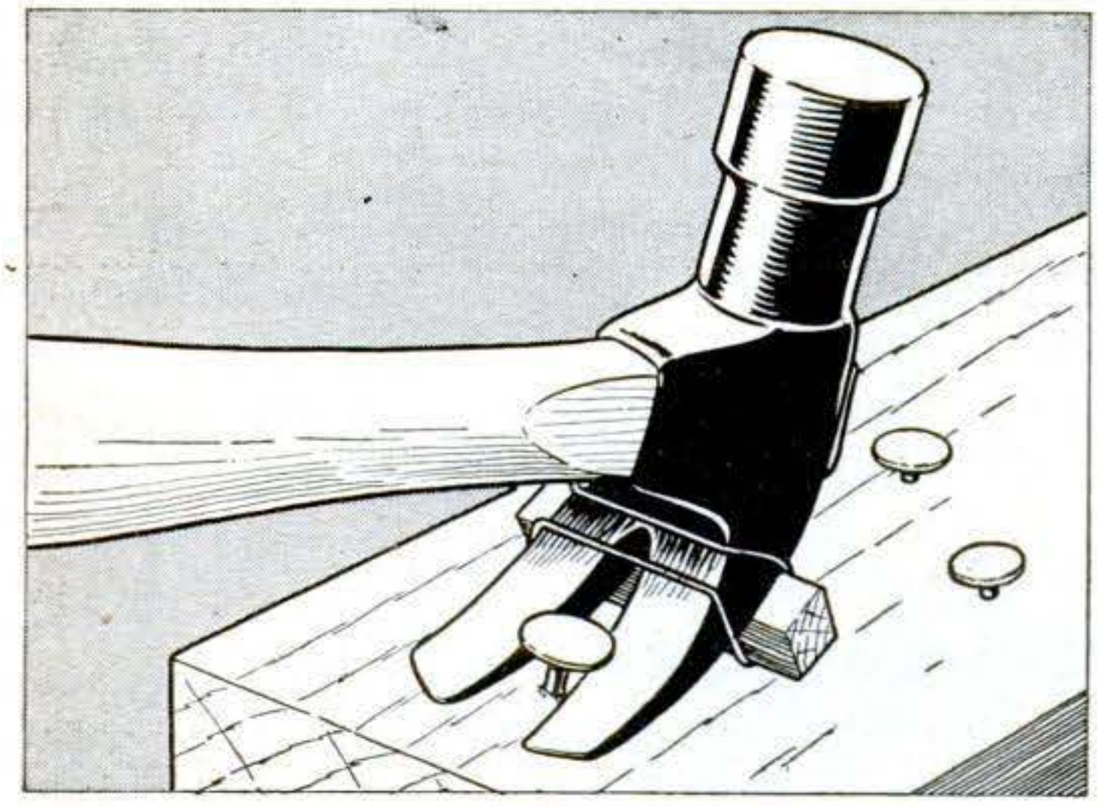
After I finished the desk, I countersunk all nail heads and filled over them with composition wood that was tinted to match the redwood. Then I sanded all surfaces smooth. I gave my desk one coat of lacquer sealer inside and out and added a single coat of gloss lacquer. This finish dries in a short time and your job is done. Mount the desk with screws through the mounting strips and into the wall studs. END



To prevent lid from dishing and to strengthen it generally, 1″ by 1½″ stiffeners (left) were nailed and glued across each end of it. Finishing nails were used throughout.

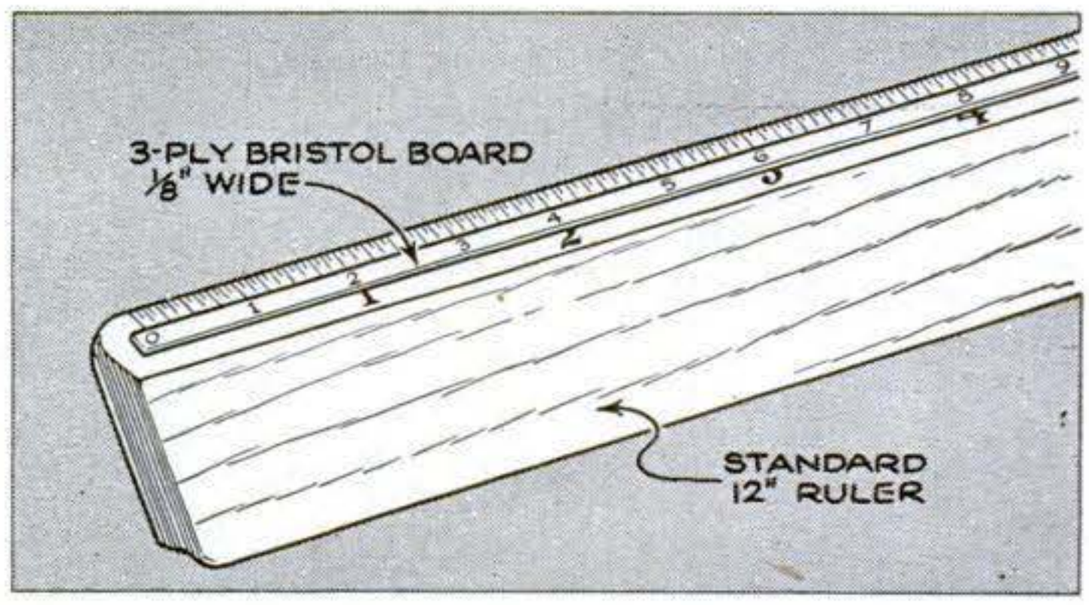


Piano hinge (also called a continuous hinge) joins desk lid to desk bottom. When open, lid is supported by a stay hinge at each end. Friction catches at each end hold lid closed.



Block Speeds Nail Pulling

WHEN you have a number of nails to pull, fasten a small block of wood to your hammer with a rubber band. The block will stay put and greatly speed up your work.—*Warren J. Wightman, Buffalo, N. Y.*



Marked Rule Shows Scale

AN EXTRA set of scale inch markings on a ruler makes it easier to produce scale drawings. Mark off the new divisions on a thin strip of Bristol board and attach the strip just below the regular ruler scale with rubber cement. The two-in-one ruler simplifies calculations and makes it easy to measure distances directly in the reduced scale.

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What You Can Do About

A Damp Basement

The three common troubles—condensation, seepage, and leakage—can be cured, but each has its own remedy.

By George H. Waltz, Jr.

PS PHOTOS BY HUBERT LUCKETT

ARE your cellar walls all wet? If they are, these winter week ends are the best time to start a campaign to dry them up. They can be remedied in most cases.

Damp basement walls may be the result of condensation, seepage, or actual leakage. Each cause of trouble calls for a specific treatment.

Leakage is the easiest to spot. It is an actual flow of water through the walls caused by the head, or pressure, of water outside the foundation. It produces not just general dampness, but general wetness with actually visible trickles. But in some cases, leakage is noticeable only after a thaw or a heavy rain.

Use a Mirror

Condensation and seepage produce visible symptoms that are much alike—damp spots or an over-all dampness. So they are often hard to tell apart. If you aren't sure which is causing your basement dampness, borrow your wife's small pocketbook mirror and glue or cement it to a wet portion of the wall. Then, four or five hours later, examine its surface carefully. If it is fogged with tiny water droplets, *condensation* is keeping your basement walls damp. If its surface is as clear and dry as when you put it into place, *seepage* of natural earth moisture through defective and porous cement or building blocks is causing your trouble.

Condensation occurs most often during the warmer, more humid months, but may also show up in winter when warm, moist cellar air comes in contact with cold basement walls. It can be cured in various ways. Better circulation of the air in the cellar, provided by open cellar windows on dry days, or a basement exhaust fan, will help. So will an electric dehumidifier or

Damp basement walls can be the result of any combination of three common difficulties—and diagnosis of the trouble first is important.

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Mirror cemented to wall will help you decide whether dampness is condensation or seepage.

large amounts of a chemical dryer such as calcium chloride. The important thing is to reduce the water content of the cellar air either by evaporation or by absorption. Chemical dryers can be obtained in either cakes or bags of powder that can be placed in various spots around the cellar. Naturally, any chemical dryer must be revived occasionally.

Sealing Up the Pores

Seepage, too, can be cured, but not so easily. Since it is caused by the oozing of natural moisture in the earth surrounding the foundation through porous wall construction, the remedy is to seal up the pores. This can be done by applying any one of a number of commercially available damp-proofers. Most of them are powdered cement-base preparations that you simply mix with water. If you pick the kinds that come in a variety of pastel colors, you can decorate your cellar walls at the same time.

Regardless of what damp-proofer you choose, the preparation of the wall surfaces is very important. Any sort of finish on them—such as calcimine or oil paint—must be removed. And all visible cracks or holes must be carefully patched with mortar after they have been enlarged and cleaned with a cold chisel and hammer and their sides have been undercut to form a dovetail that will hold the patch firmly in place.

In applying the damp-proofer, brush the material into the wall to fill every pore. Start at the bottom and gradually work up. Since this is a messy process, it's best to wear an old hat and goggles or glasses.

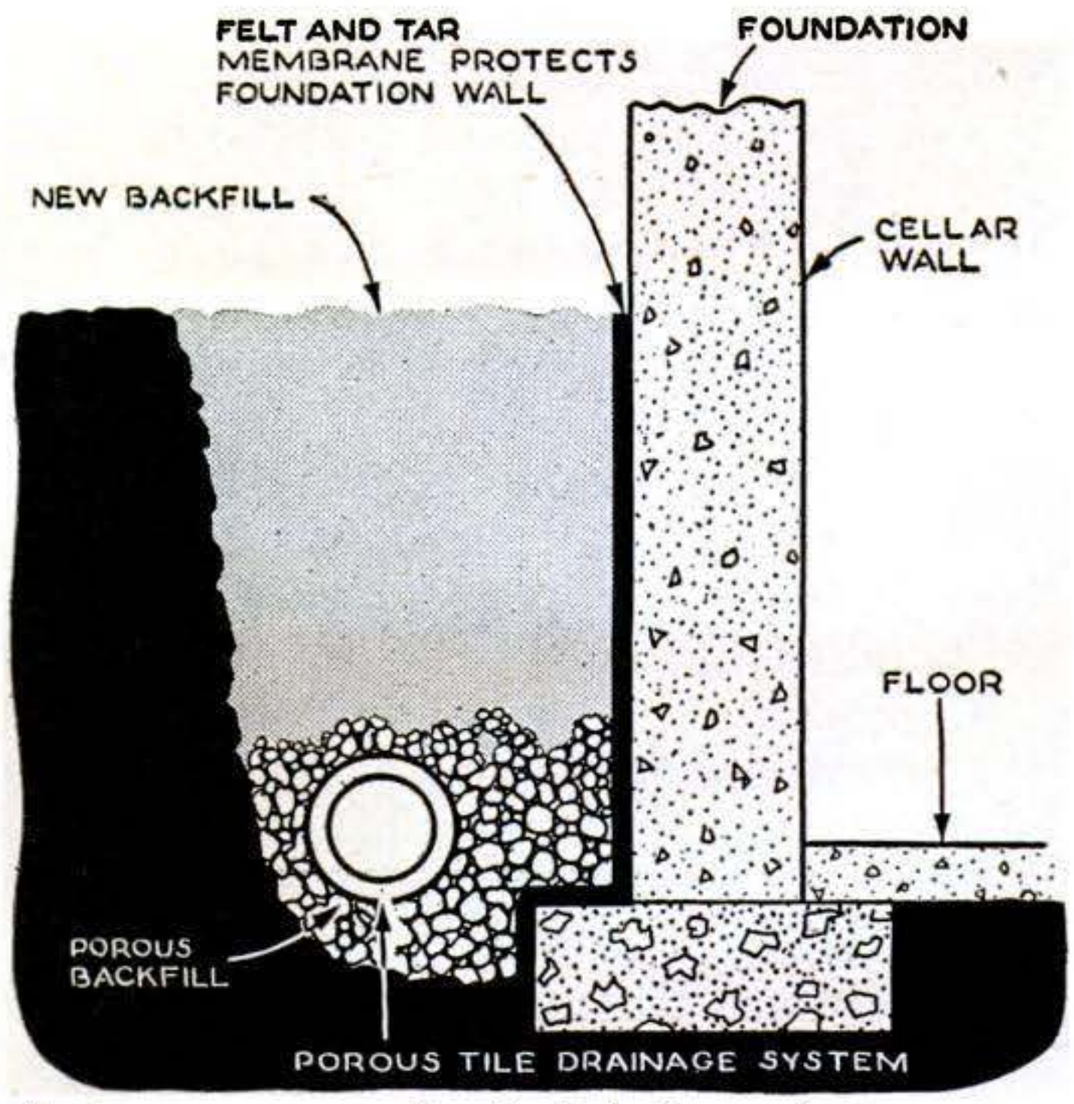
Two coats of most damp-proofers are needed. The walls should be thoroughly wetted down after the first coat has dried and before the second one is applied. The drying time, in most cases, varies from about two to four hours. Don't rush it. After the second coat has dried and won't brush off, the wall should be wetted down again and then again every twelve hours for the next three days. This continual wetting and drying helps to cure the mixture slowly and makes it an integral part of the wall.

If, after the second coat has been thoroughly cured and allowed to dry, you see moist spots here and there, some of the larger pores in the wall surface have not been completely filled. They should be enlarged with a cold chisel, filled with patching cement or a 1-to-2 mortar, and re-treated with the damp-proofing mixture.

Since all cement-base damp-proofers are quick-setting preparations, be sure to wash off all drippings and spatters that might mar your basement floor or other surfaces. If you let them stand too long and they harden, you'll have trouble removing them.

Grading May Stop Leaks

The most difficult wet basement wall to fix is one through which water is being forced by the pressure of accumulated water outside. If you can see water on the wall, not just dampness, leakage is your trouble. The root of the trouble can range all the way from such an easily corrected thing as a misdirected downspout, or a leaking gutter that floods the ground in contact with the foundation walls every



Only sure cure for bad leakage is to encase basement in a "membrane" of felt and tar.

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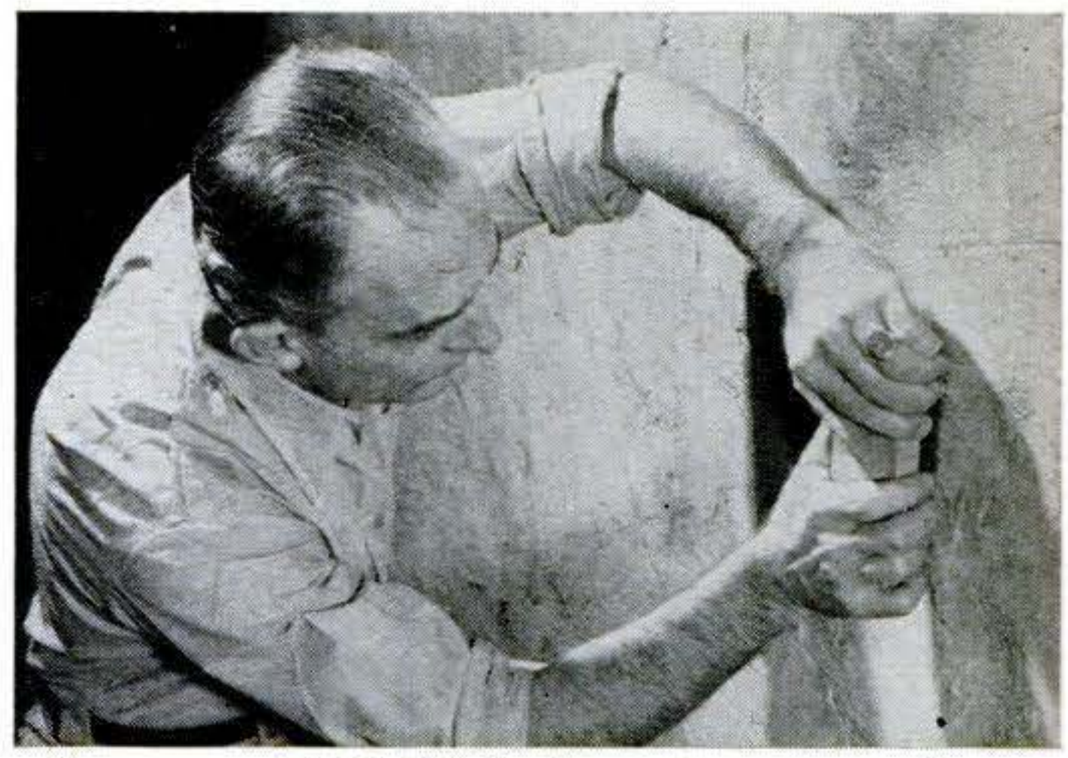
Cement-Base Damp-proofer Will Usually Stop Seepage

Old finish must be removed first with wire brush, paint remover, or solvent made by dissolving 1 lb. of tri-sodium phosphate in 1 qt. of warm water. Holes and cracks must be cleaned out with a cold chisel, sides undercut to form a dovetail, and then filled with mortar (1 cement, 2 sand, water). If actual leak is visible, a quick-setting patching cement must be used. After patches set, wet wall down with fine spray from hose. Finally, mix damp-proofer according to manufacturer's directions and scrub into wall with a stiff-bristled brush. Most damp-proofers require two coats.

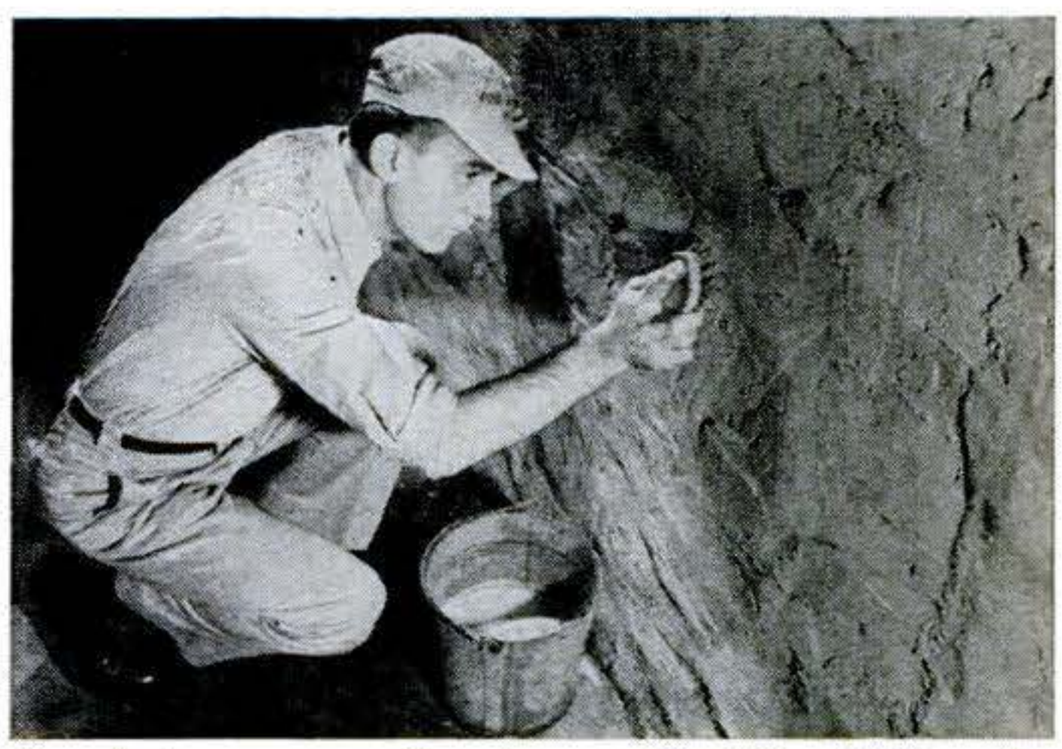


Remove old finish before damp-proofing.

Clean out holes with cold chisel.

Fill holes solidly with a 1-to-2 mortar mix.

Wet wall down with spray from garden hose.



Scrub damp-proofing into wall with stiff brush.

time it rains, to a high ground-water level that keeps your cellar walls continually surrounded with water. Regrading the land that surrounds a house, to provide a better run-off, may solve your problem. And sometimes replacing a porous backfill that originally was placed against the foundation wall with less porous earth will do the trick.

But the only sure cure for really stubborn leaks is a "membrane" that seals the outside of the foundation. This entails digging a trench completely around the house to expose the foundation and then applying alternate layers of felt and hot tar to form a waterproof protective coating. In extreme cases, this watertight envelope can be augmented by special drains—a network of porous tile placed at the bottom of the ditch and arranged to carry the water to lower ground or a sump.

But don't jump to conclusions if you are plagued by a damp cellar. Remember it may be caused by any one of a number of things—or a combination. END

Would a dry well solve your drainage problems? See* POPULAR SCIENCE *next month.

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Sanding Stock to Thickness on Your Lathe

CRAFTSMEN and modelmakers often need a piece of wood of an in-between, non-standard thickness. To work it down by hand is slow and inaccurate. Here's a thickness sander that works fast, to close tolerances, and will handle good-sized pieces.

You can make the sanding drum, if you haven't one already, by turning a 2″ by 2″ by 8″ piece of hardwood to a cylinder of uniform diameter. Saw a ⅛″ by ¼″ slot lengthwise, tuck the ends of the paper into this, and wedge them with a strip of wood.

Making the Planer

Use ¾″ hardwood for all the planer parts except the adjusting-screw bracket. Because of its shape and the resulting short grain, this is best made of plywood. Select a perfectly flat, true piece for the table, as this will determine the accuracy of the work the planer will do. Make the table support high enough to bring the table, when level, about ⅛″ below the drum. The bracket should be 1″ lower than the table support. This will give you a thickness range of ⅛″ to 1″.

The height-adjusting screw is made by running a wing nut tight against the head of a 3/16″ bolt. Drill an undersized hole through the bracket and turn the bolt into it to cut its own threads. Insert a wing bolt at right angles to lock the screw.

Thread three leveling screws into the base, locating these so that they can be reached with the table in place. They provide tilt adjustment to bring the table parallel to the drum.

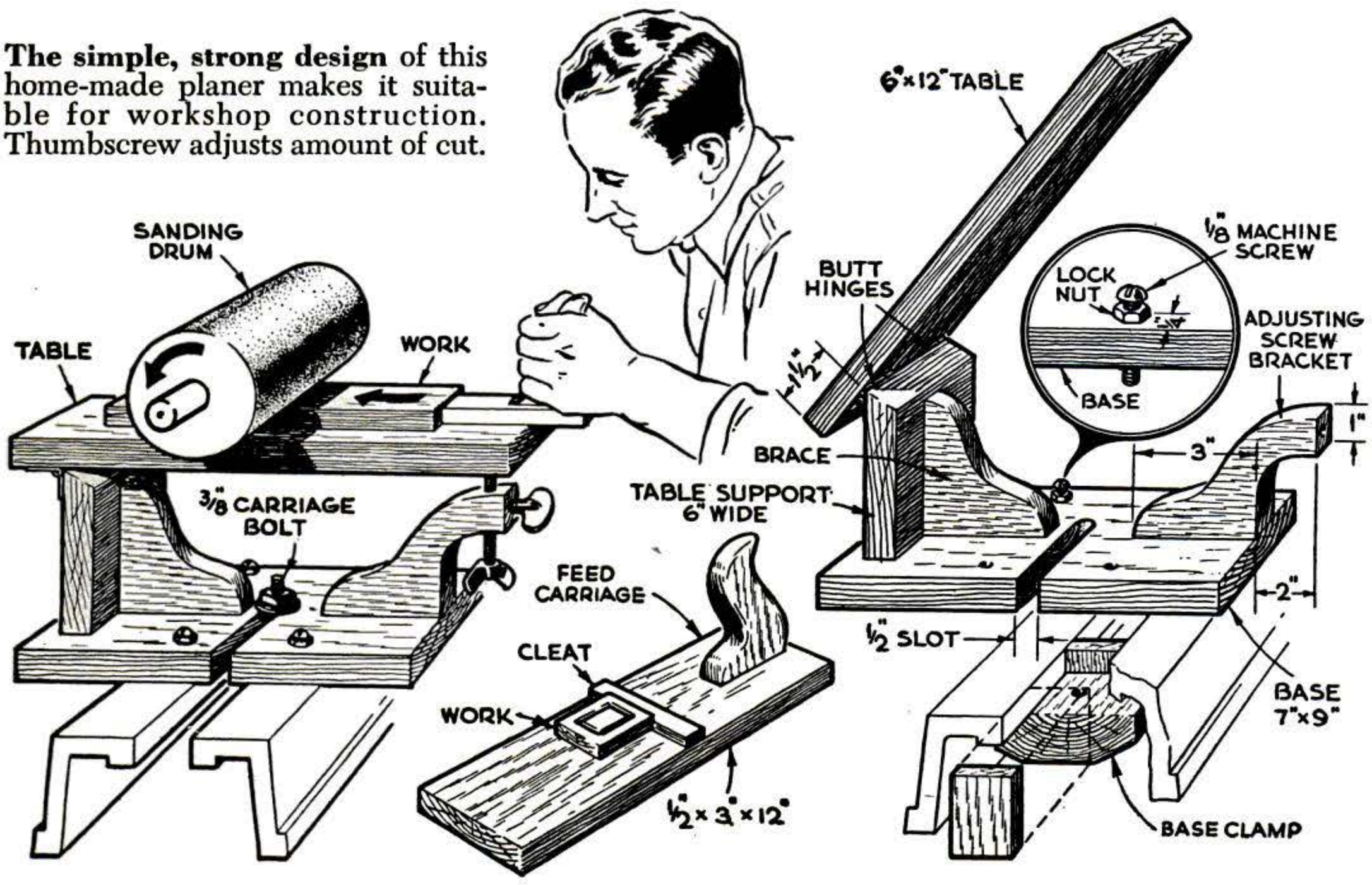
A base clamp for mounting the planer on the lathe can be built as shown below. Cheek pieces center the clamp block between the ways. You may be able to use your tool-rest clamp instead of making one.

How To Use It

Open-coated, fairly coarse garnet or aluminum oxide paper, run at medium to high speed, usually works best. Fine papers tend to clog up. Be sure to feed work *against* rotation of the drum. Run the lathe backward or, if your motor doesn't reverse, feed stock in *from the back*. Adjust the table to take a light cut at each pass.

To check adjustment, run a wide piece through and measure it at both edges with calipers. If thicknesses aren't equal, adjust the leveling screws. A simple feed carriage, made as in the drawings, is handy for small pieces.—*Roy Rogers, Brooklyn, N. Y.*

The simple, strong design of this home-made planer makes it suitable for workshop construction. Thumbscrew adjusts amount of cut.



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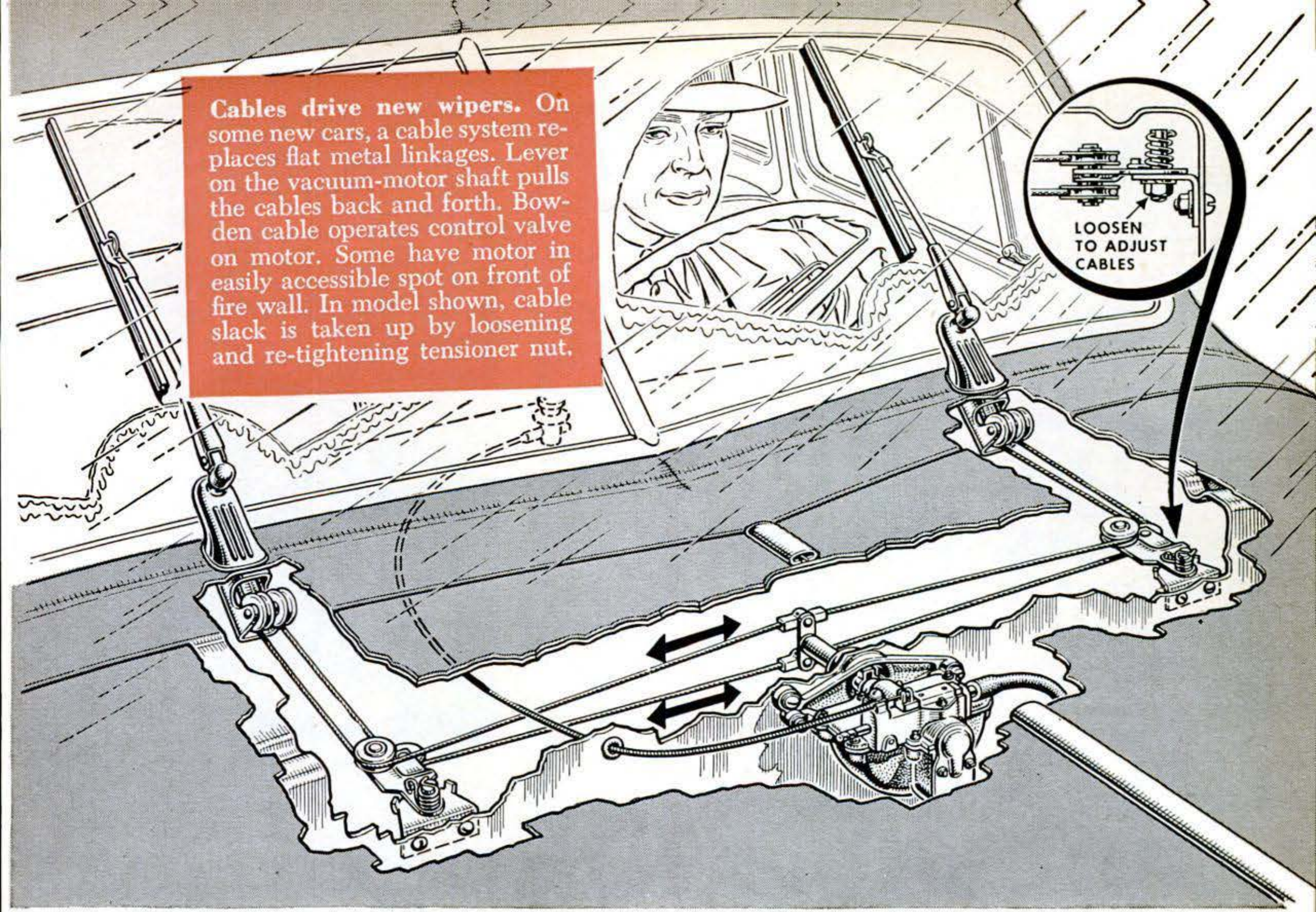
Cables drive new wipers. On some new cars, a cable system replaces flat metal linkages. Lever on the vacuum-motor shaft pulls the cables back and forth. Bowden cable operates control valve on motor. Some have motor in easily accessible spot on front of fire wall. In model shown, cable slack is taken up by loosening and re-tightening tensioner nut.



How to Pep Up Your Wipers

If your wiper is dragging its feet, it probably needs one of these treatments.

By R. P. Stevenson
PS PHOTOS BY HUBERT LUCKETT

LIKE grandpop, vacuum windshield wipers may slow down with age. Very often the change comes so gradually that you do not notice it.

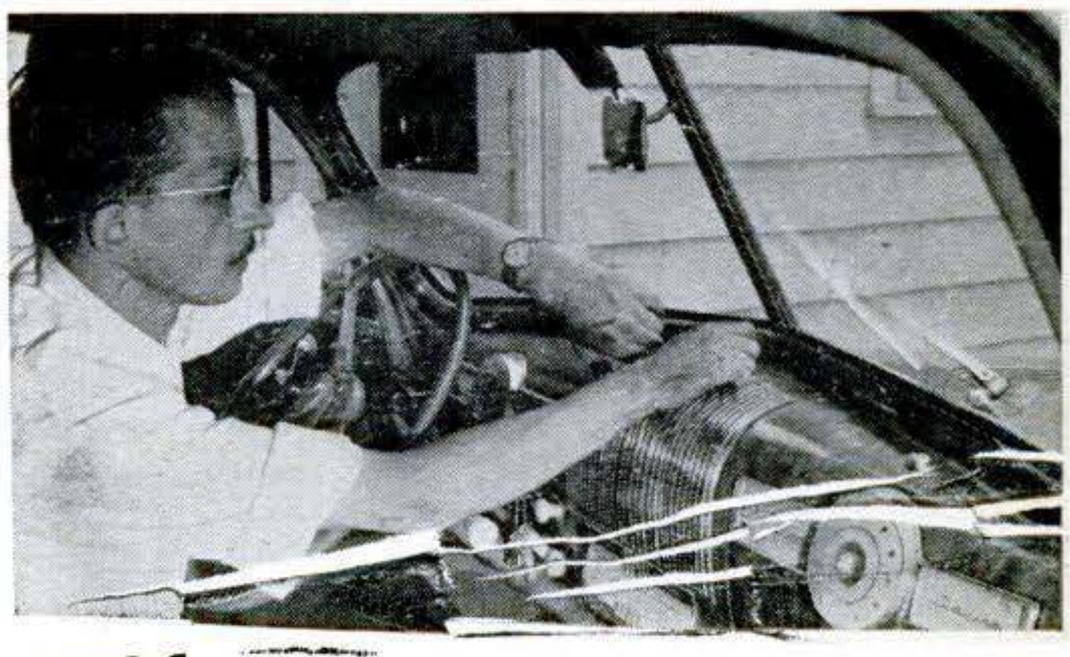
But it is often easy to check your wipers and bring them up to snuff. Anyone can usually spot the trouble—and perhaps take care of it—without calling in a high-priced mechanic.

In most cars all the vacuum that powers the wipers comes from the intake manifold, but in some a vacuum pump on the fuel pump lends a helping hand when manifold vacuum drops. A hole or poor joint in the connecting lines will divert the vacuum (suction) and slow down or stop the blades. An inoperative vacuum pump will leave the blades idle just when you need them most.

Checking the vacuum line. The hose may look good but be imperfect. To check, remove it from the car and hold your thumb firmly over one end while you blow smoke into the other. Escaping smoke will show up any holes.

Make sure, too, smoke passes through the

What's their speed? On dry glass, your wipers should make at least 100 sweeps each minute. Count the strokes (from one side to the other) with the engine idling and the wiper control turned to full speed. If you find yours below par, this article may help you speed them up.



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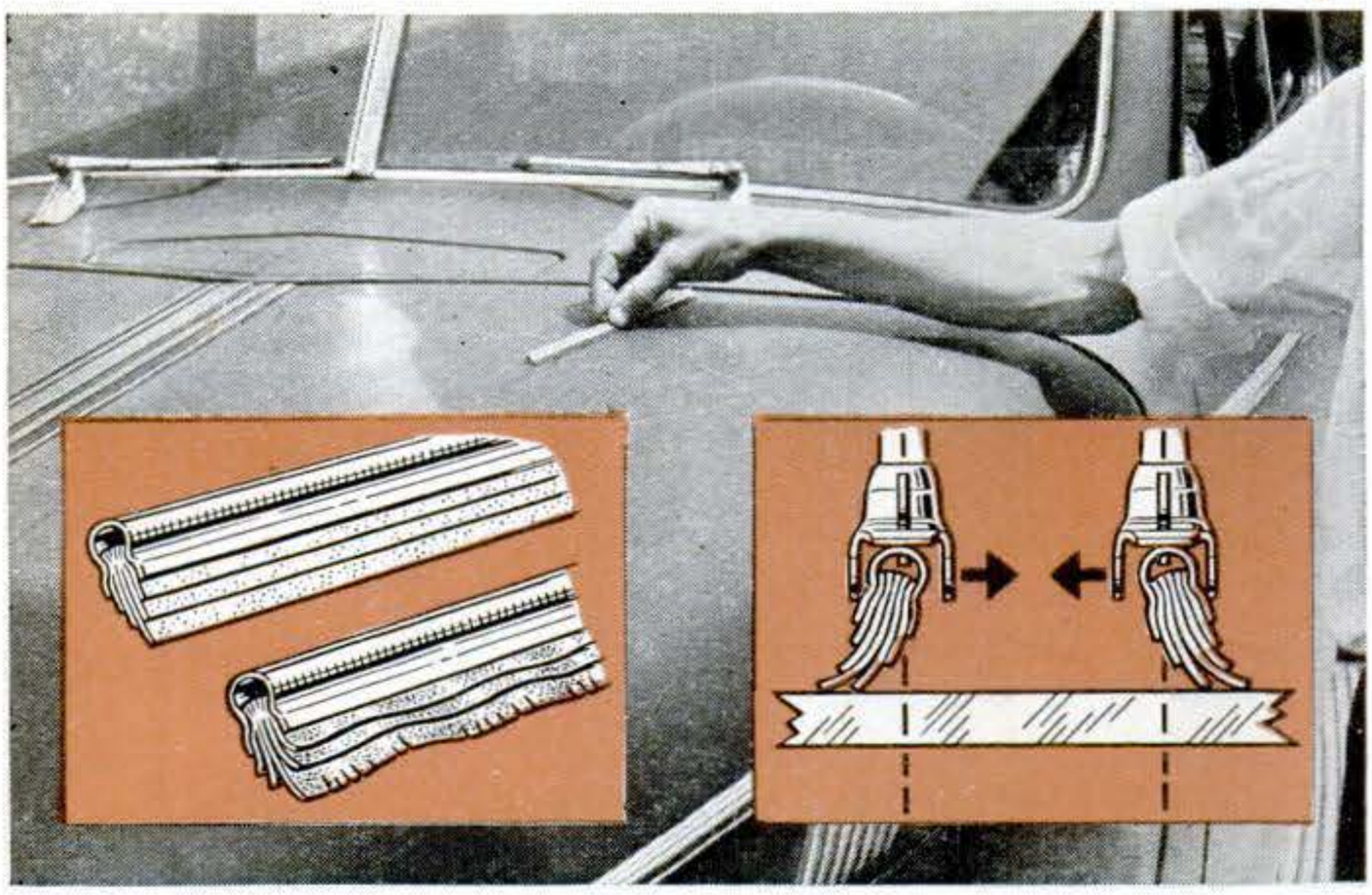
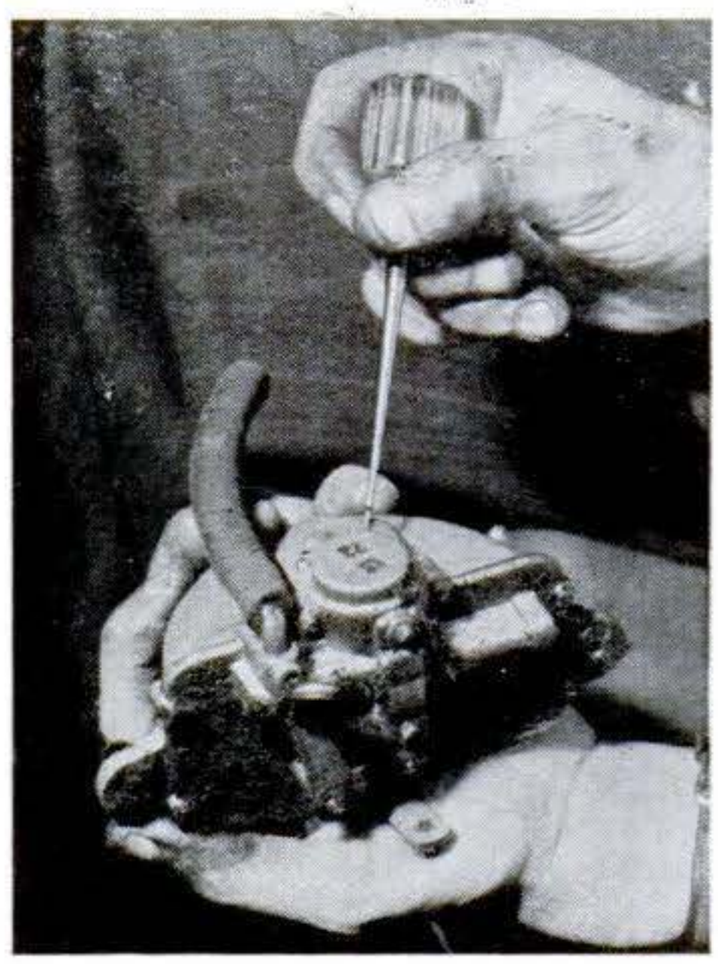
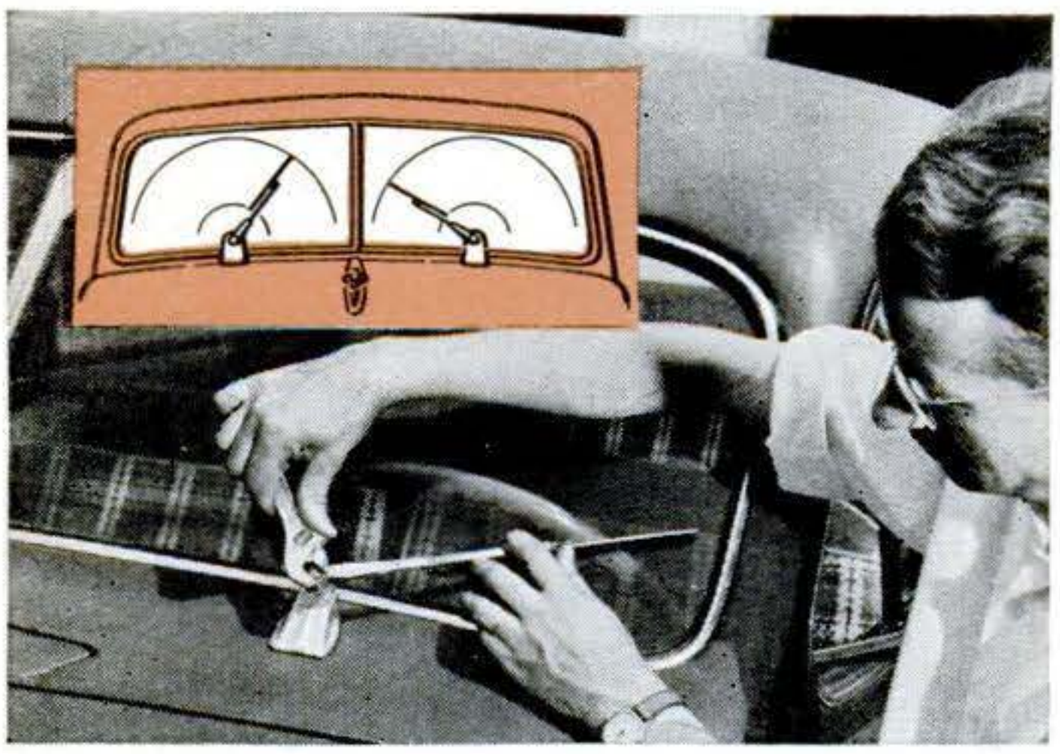


Are the blades good? Unless the rubber is flexible, they won't wipe well. Test this by pressing on a flat surface, as shown in the photo. The edge also must be straight. If it's wavy or the rubber is hard, buy new blades. When operating, the blades should tilt from side to side and be pulled, not pushed, by the arms. If the blades don't tilt and you can't adjust, replacement wiper arms are usually your best bet.

Is breather hole clogged? See how dirty the motor below was when it was taken from car. Vacuum motor must have air to operate right. Clean out breather hole with sharp tool.





Is the stroke even? One blade sometimes lags behind the other as shown in sketch (above). To correct this, remove the arms, start the wiper motor, and let it stop with the shafts in parked position. Then put back the arms in parked position. On some older cars the arms are tightened by turning a lock nut as shown in the photo. The majority, however, slip on or off shaft when bent at the hinge.

Does the hose leak? If there's a hole in the hose, your wipers won't get full vacuum. You can test it for leaks by blocking one end and blowing cigarette smoke into the other.

hose without restriction. A wiper can be knocked out by a hose that has collapsed inside, blocking the vacuum, without any sign of deterioration on the outside. In putting back the tubing, be careful that it forms a tight seal over the connecting tubing.

Vacuum hose is most likely to go bad at the intake-manifold end, where it is most subject to engine heat. You can sometimes cut off a defective end and put the old hose back. But it usually pays to install new hose if you find the old one leaking, plugged, kinked, oil soaked, or otherwise defective. It's also a good idea to unscrew the intake-manifold fitting and scrape out its inner end. Deposits there may narrow down the passage and reduce vacuum action.

Testing a vacuum pump. On cars equipped with a vacuum pump, the wipers should work at nearly constant speed regardless of engine speed or load.

To test the pump, disconnect the outlet line (the one that leads to the intake manifold), turn on the wiper control, and slowly accelerate the engine. If the pump is in good shape, the wipers will begin working at about 15-m.p.h. engine speed and reach maximum speed at about 40 m.p.h.

If the wipers fail to work when you make this test, check the vacuum lines and the vacuum motor before condemning the pump. This can be done by detaching the windshield-wiper line at the pump and connecting it to the already detached outlet pipe with rubber hose. If the lines and vac-

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uum motor are okay, the wipers will work at full speed as you speed the engine up.

What about the motor? If your wipers fail completely, check over the vacuum lines first. As a double check, remove the line at the vacuum motor and run the engine with your thumb blocking the line. If you feel a steady suction, the vacuum is probably okay, and this suggests that the motor is defective.

To rule out any possibility of binding linkage, disconnect the two connecting arms at the motor-drive lever. (On cable-operated units, disconnect the cables from the swivel connectors.) Then start the engine and try to operate the vacuum motor. If there's a mechanical push-pull link between the control button and the motor, be sure this is turning on the control valve properly.

If the vacuum motor fails to start, your best bet generally is to trade it in. Vacuum motors *can* be repaired, but it's a tricky job.

On one face of a vacuum motor you'll find a hole that allows air to enter as the mechanism operates. Dirt or lint clogging the hole will slow the wiper action.

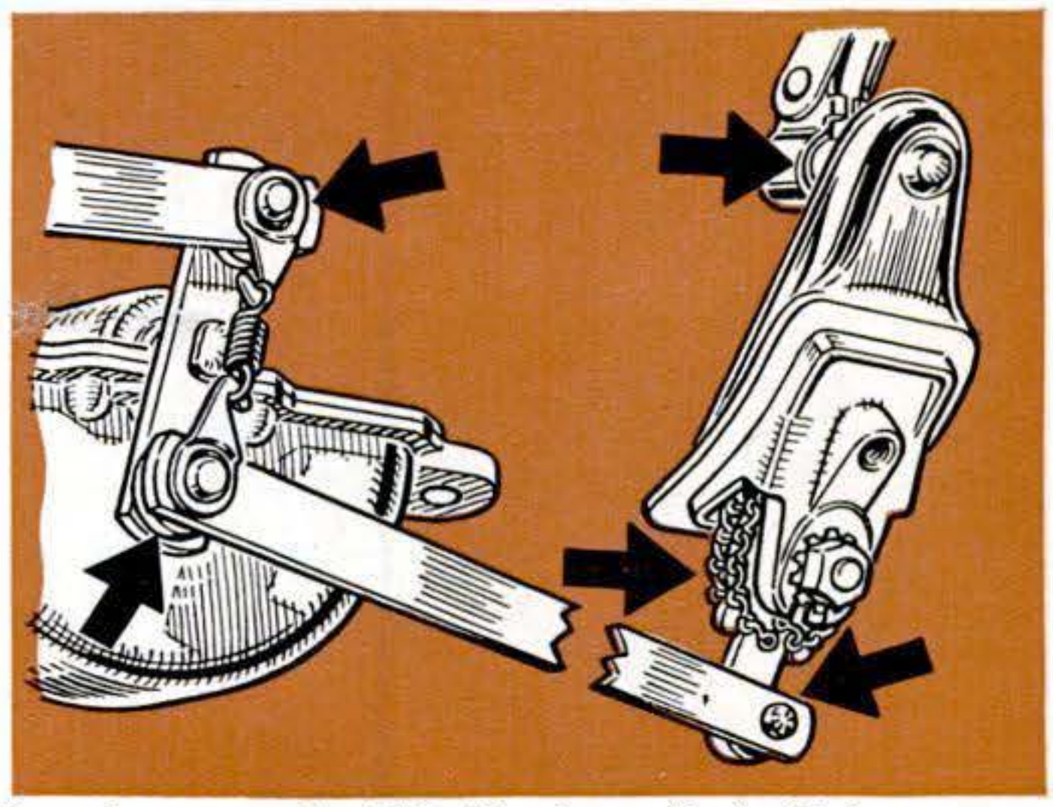
Oil the linkages. All moving joints in the wiper system should be lubricated occasionally. Squirt a little light penetrating oil into the felt washers that separate the parts. Remove the wiper arms and shoot some around each shaft.

On late cars the arms are removed or replaced by flexing them at the hinge. This retracts a slide lock and permits the serrated arm head to slide off or on the driving burr on the shaft. On some earlier snap-on types, a separate wire-lock hooks over the back of the driving burr.

With the connecting arms disconnected from the motor-drive lever, work each side by hand to be sure everything moves freely. If they bind, oil may help. Or you may find that the linkage rubs against other parts under the instrument panel. Clear these away.

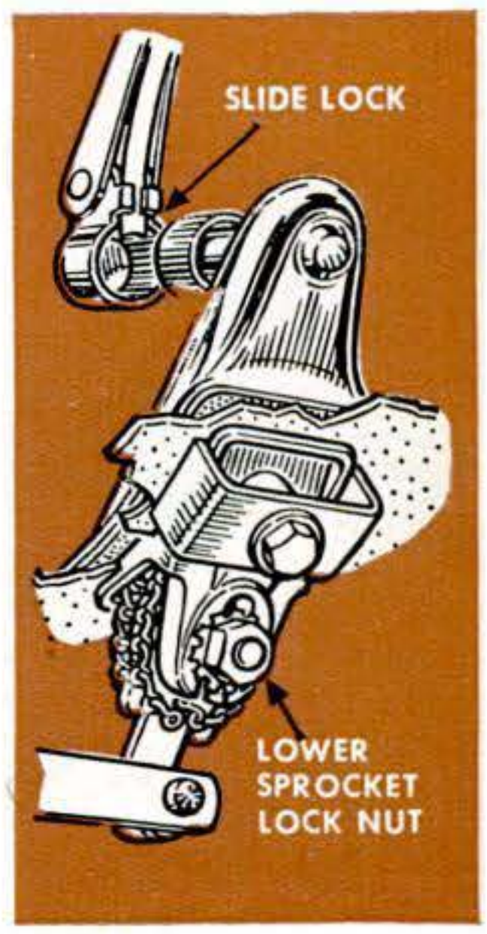
The motor should be securely attached and centered on the mounting bracket so the drive lever doesn't bind the linkage. Sometimes unequal blade strokes can be cured by shifting the motor slightly.

Are drive chains loose? You can find out by parking the wipers and removing the blades. Lift the arm just off the glass and move it up and down by hand. If the end of the arm moves more than 1½ inches, without forcing, tighten the chain as described in an accompanying sketch. Be sure to tighten the nut that holds the transmission housing. If loose, the casting will rock.



Do they need oil? Squirt a little light penetrating oil on the points indicated to eliminate squeaks and improve the speed. If wipers are cable-operated, apply light oil to pulley bearings each time the car is lubricated. Also smear light grease on the cables at the points where they run back and forth through pulleys.

Are drive chains loose? If you find they are, loosen lower sprocket lock nut, pull down the lower sprocket, hold it firm, and tighten nut. To do this, you may have to remove the unit from car. Tighten unit well when you put it back.



On cars with cable-operated wipers, the cables sometimes require adjustment. You may find, however, that yours have a spring and ratchet that automatically take up slack.

It is important that the cables run true on the tensioner pulleys. If they don't, bend the tensioner assemblies either up or down. But never operate the wipers by hand, for this could damage the cable connections. END

Cover Your Pipe for Safety

COVER your pipe when smoking outdoors or while driving to prevent a burned-out bowl and dangerous flying sparks. This simple, windproof cover, made from the top of a 35-mm. metal film case, will fit snugly over many pipes. If the fit isn't snug, crimp the edge of the cover with pliers.

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Gus Tames a Runaway

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Engine

First it wouldn't stop, then it wouldn't go, and the contrary engine had to get Gus's friend home by New Year's.

By Martin Bunn

ABOUT ten months ago, one of the big electrical companies put up a branch plant and laboratory just outside of our town. Part of that industrial decentralization program I've been hearing about, I guess. Anyhow, it brought quite an influx of new people into our community—most of them engineers and scientists.

One is a young fellow by the name of Jim Harrison. Jim, a veteran and unmarried, comes from Indiana, where not too long ago he graduated from engineering school, thanks to the G.I. Bill. Right now he's staying at Mrs. Paley's boarding house.

Everyone who knows Jim likes him, especially Gus Wilson whose Model Garage is one of Jim's favorite stopping-off places. Not long ago, Gus had helped Jim do a first-rate job of grinding his valves. Then back last summer, when Jim had just bought his secondhand car, Gus had shown him how to re-time the motor, adjust the carburetor and hook up a water injector, put in a new exhaust pipe and muffler, and replace a cracked windshield. Under Gus's direction, Jim had worked over the old car until he had practically rebuilt it.

Jim Calls for Help

Gus hadn't seen Jim for several weeks when one night recently Gus was strolling down our main street doing a little window shopping. Suddenly he heard someone shouting his name. It was Jim and he was running across the street toward Gus.

"Gosh, am I glad to find you," Jim gasped. "Been looking all over town for you. Can you spare some time? I'm in a spot, and you can help out."

"Sure thing, Jim," Gus said. "But let's stop off here at Dan's Grille for a coffee."

"Now, what's it all about?" Gus asked after they'd settled down on their stools and Dan had served up two steaming cups.

"Well," Jim began hesitatingly. "You may remember that I'd been hoping to take my two weeks vacation and drive along home

Gus aimed the flashlight into the carburetor's throat. "Even a carburetor can develop tonsils."

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to see my Mother and Dad at New Year's."

Gus nodded.

"I'd planned to start out tomorrow night right after work," he went on, "but I guess that's all off now."

"What's the matter?" Gus inquired. "Work at the plant too heavy and they've asked you to put off your vacation?"

"No, it's not that," Jim replied glumly. "I can still have my vacation. It's my car Something's gone screwy with it and I'm blamed if I can spot it It started acting up last night on my way back to town from the plant. I was breezing along the outer road at about forty and took my foot off the gas to slow down for an intersection. Instead of slowing down, the fool car just took the bit in her teeth and never slackened. Before I could throw out the clutch, I was through the intersection. Then all of sudden the engine began to spit and sputter and finally died."

First She Quits and Then She Clicks

"Would it start again?" put in Gus.

"Not right away," Jim replied. "So I got out and lifted the hood to take a look. As I started to poke my head in under the hood, I heard a distinct metallic click."

"A metallic click?" questioned Gus.

"Yeah, you know, like something snapping back into place," explained Jim. "I couldn't find anything that looked wrong, so I decided to try the starter again. She kicked right off."

"Did the motor run evenly?" Gus asked.

"Never ran smoother," Jim pointed out, "but about a half mile further down the road she took the bit in her teeth again and continued to roll along at forty, accelerator or no accelerator. Then, just like the first time, she gasped and died. She did that about four times before I got into town."

"Sounds like something's binding somewhere in your throttle linkage," Gus offered. "Probably sticks when you've pushed the gas pedal down far enough to hit forty, stays there for awhile, and then pops loose."

"That was my first guess, too," Jim confessed, "but no luck. Besides, that wouldn't account for the dying act."

"No, you're right, it probably wouldn't," admitted Gus. "How did she act today?"

"Same business all over again," Jim grumbled. "Took me an hour to get to the plant."

"Where's the car now?"

The Patient Gets a Home Visit

"Out in the garage in back of Mrs. Paley's," Jim said eagerly. "Will you come over and take a look at it?"

Ten minutes later, they were in Mrs. Paley's garage and Gus, hat on back of head, was peering down at Jim's balky motor.

"The throttle linkage seems okay, just as you said," Gus muttered as he moved the throttle rod back and forth. "Doesn't bind at all. Have you looked to see if there's dirt or anything that might be jamming the throttle valve?"

But before Jim could answer, Gus had lifted off the air cleaner and was peering down into the carburetor's throat.

"Looks clean," Gus announced. "Let's take a little spin and see if she'll do a repeat performance for me. Got a flashlight?"

"She'll repeat all right. I'll guarantee that," Jim grumbled as he slid in behind the wheel, pulled a flashlight from the glove compartment, and handed it to Gus who had climbed in beside him. "I'll bet we don't get a quarter mile out on the state road before old Nellie here runs away and then dies gasping for breath."

There's Life in the Old Girl Yet

Gus noticed that the car started easily enough, and, as Jim weaved his way through town, he marveled at how well the car ran in spite of its age.

Things happened just about as Jim had predicted they would. They'd no sooner hit the state road and gotten the car up to forty when, at a nudge from Jim, Gus looked down at the floor boards. Jim's foot wasn't on the accelerator, yet the car was rolling along at about forty-two miles an hour.

"Automatic pilot," Jim said with a chuckle, but his laugh was interrupted by sputterings

[*Continued on page 234*]

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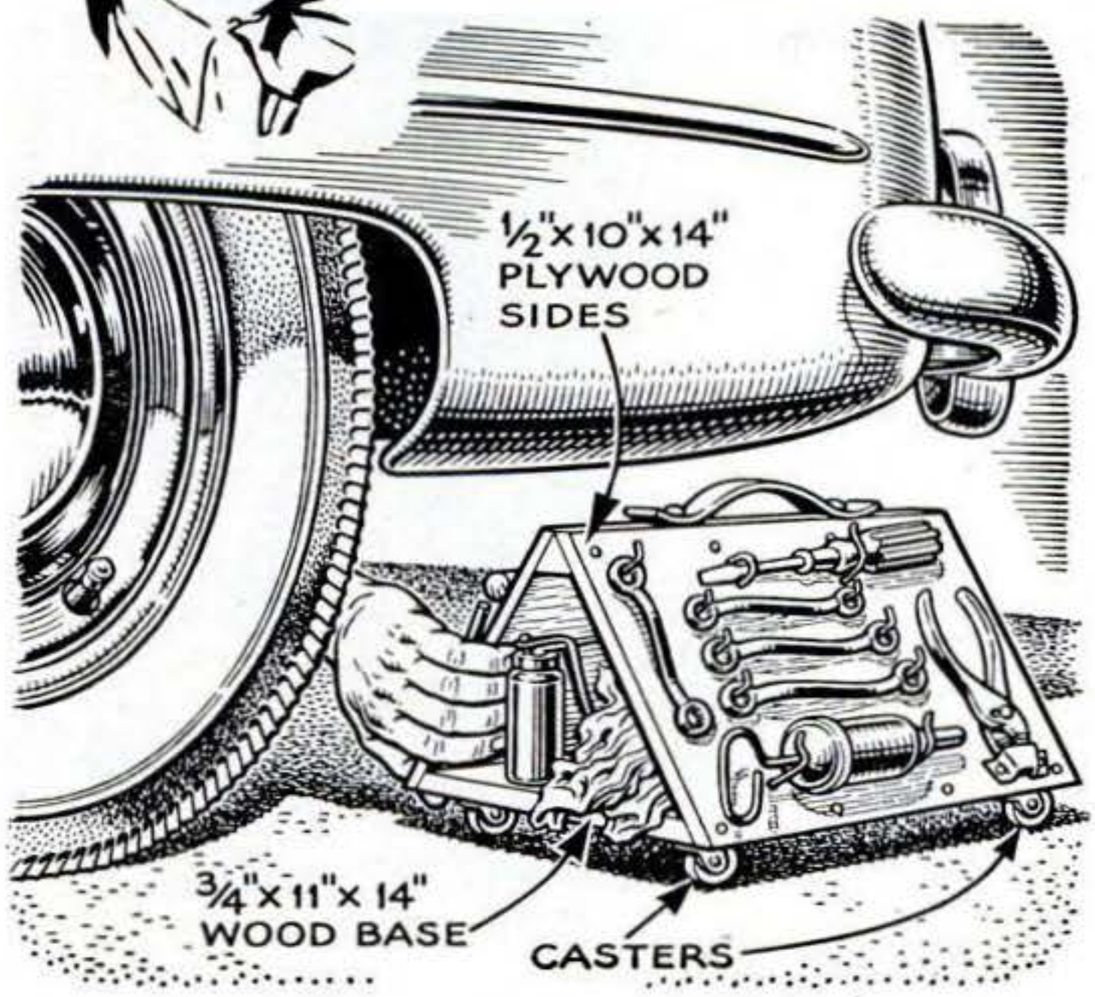
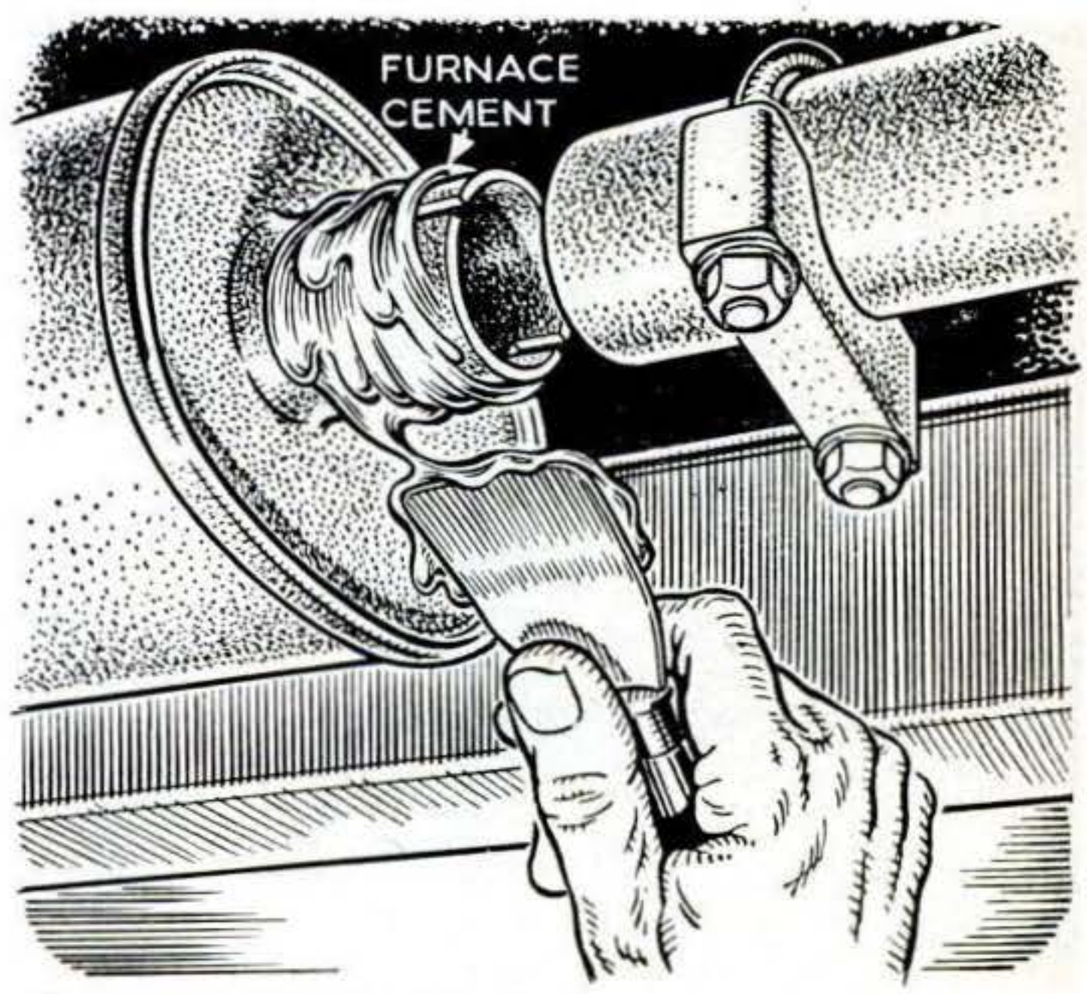
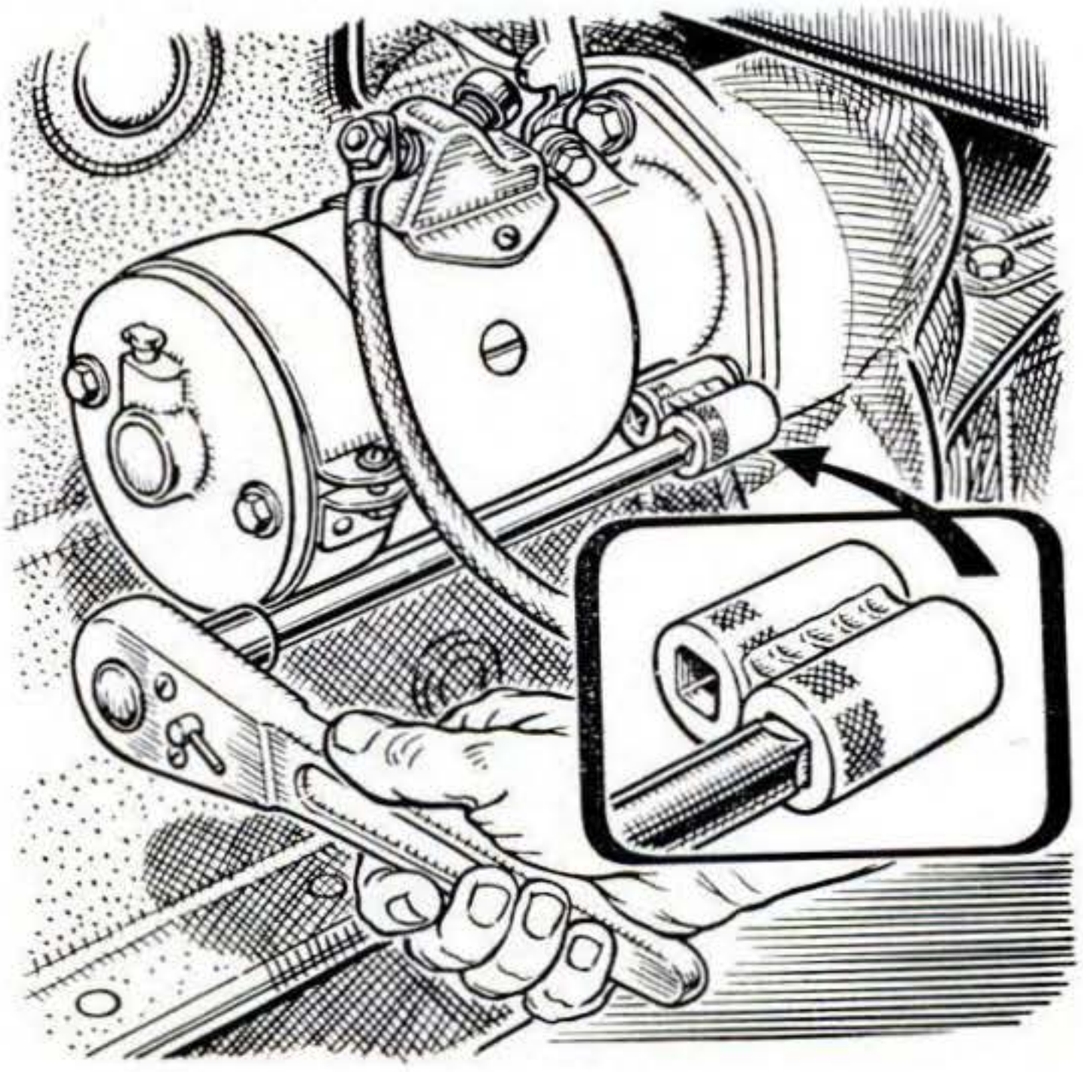
Hints from the Model Garage



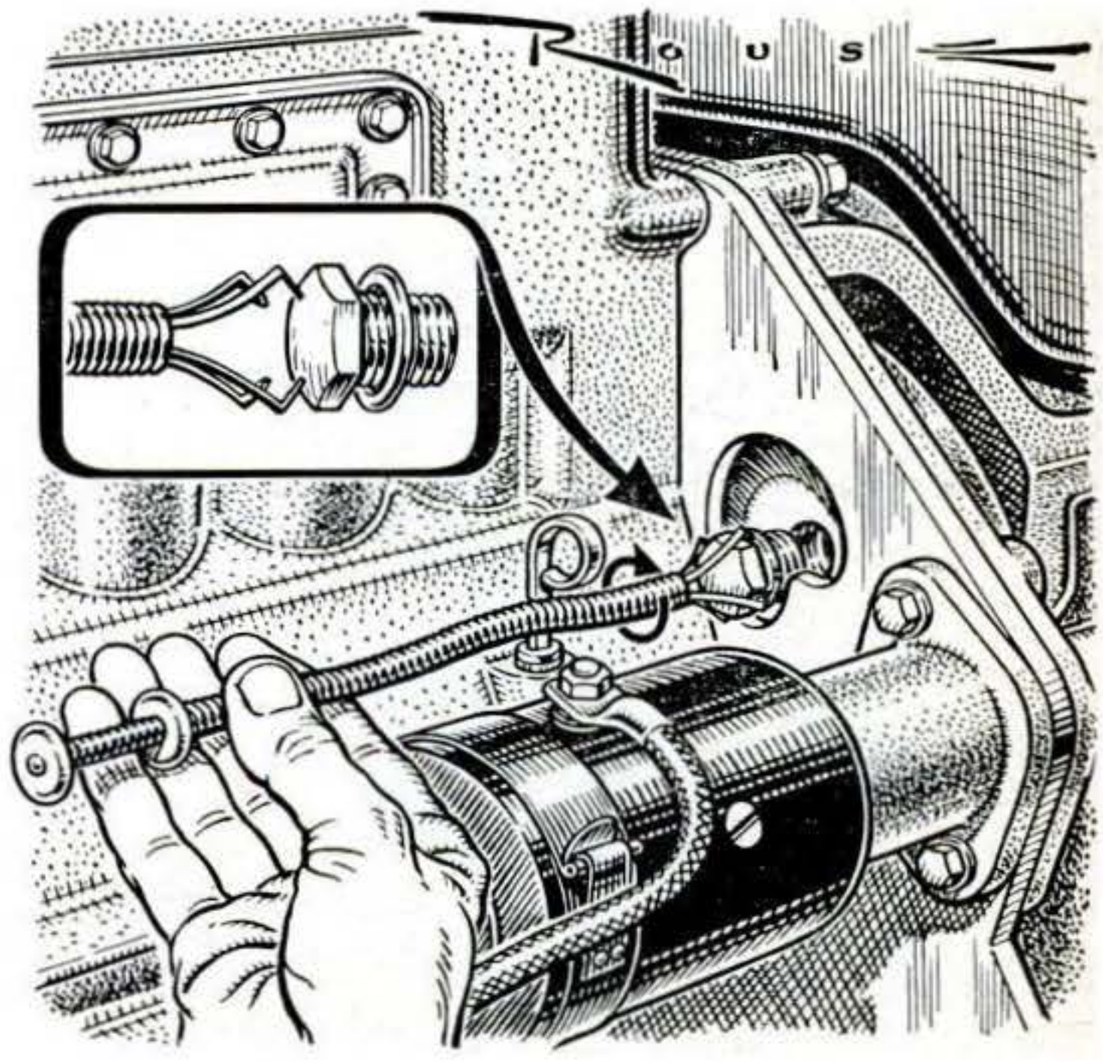
Tool Dolly a Big Help. A mechanic lying on a creeper can keep his tools handy with a low dolly like this. Use the triangular space inside for rags, pump oilers, and the like. The dimensions shown make a dolly of a convenient size.



Cement Seals Tailpipe Joint. In fitting a tailpipe to a muffler, you can get a better seal by applying a little furnace cement before slipping the units together. A 20-cent can of cement is enough for a dozen or more such jobs.



Offset Socket Turns Nut. In loosening or tightening starter bolts on some cars, you can't use a socket wrench because there's no room for the handle. For such jobs, Marion L. Rhodes, Knightstown, Ind., welded two sockets together side by side. With these and an extension rod, he can take a half turn at a time.



Grabbing Tool Saves Plug. If you've ever filled a Hudson wet clutch, you know how easy it is to drop the plug inside the housing —and how difficult it is to get out. Some mechanics stuff in a rag to catch it, but here's a better way: Buy a flexible grabbing tool like the one shown and use it for this job.

Turn the page, please, for four more auto hints.

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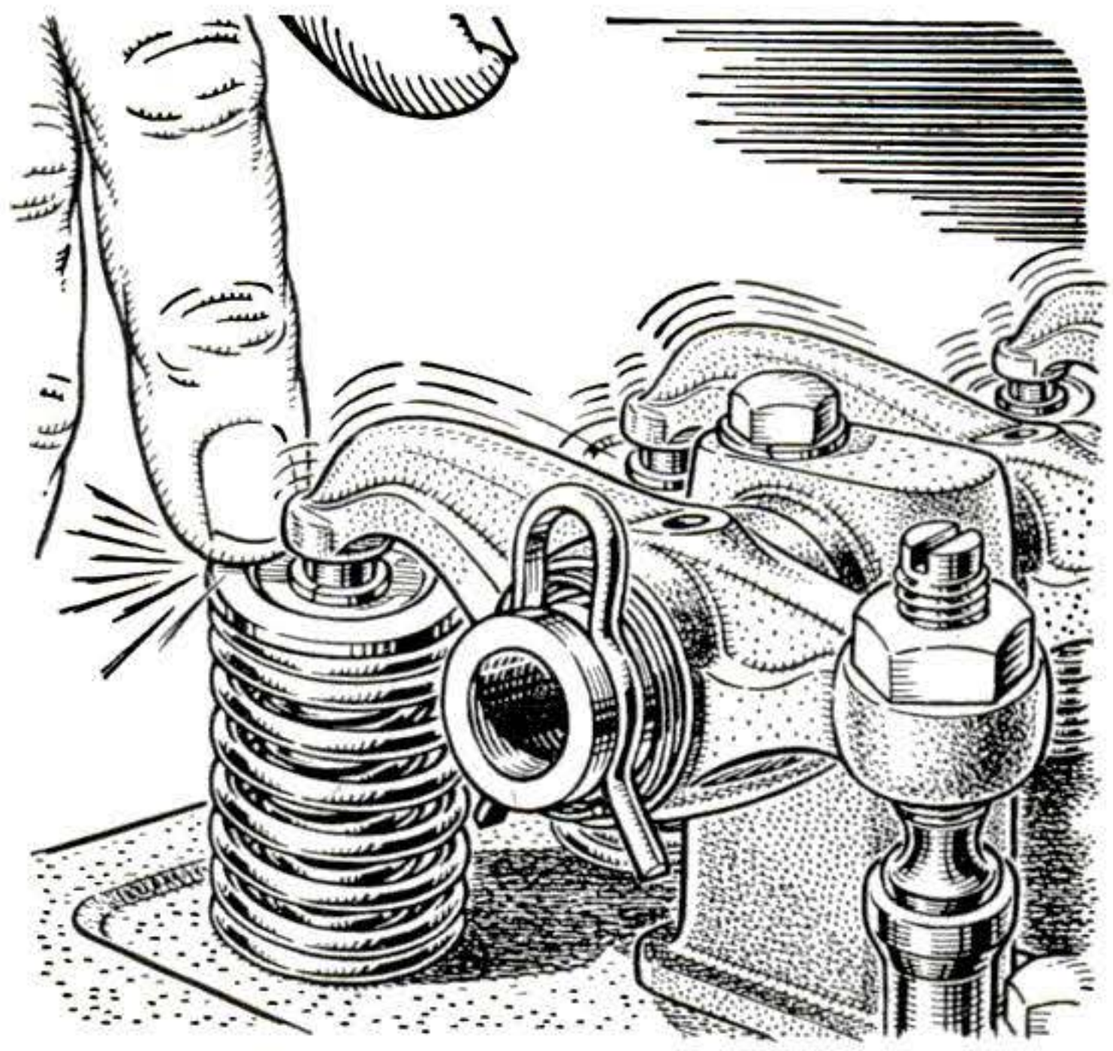
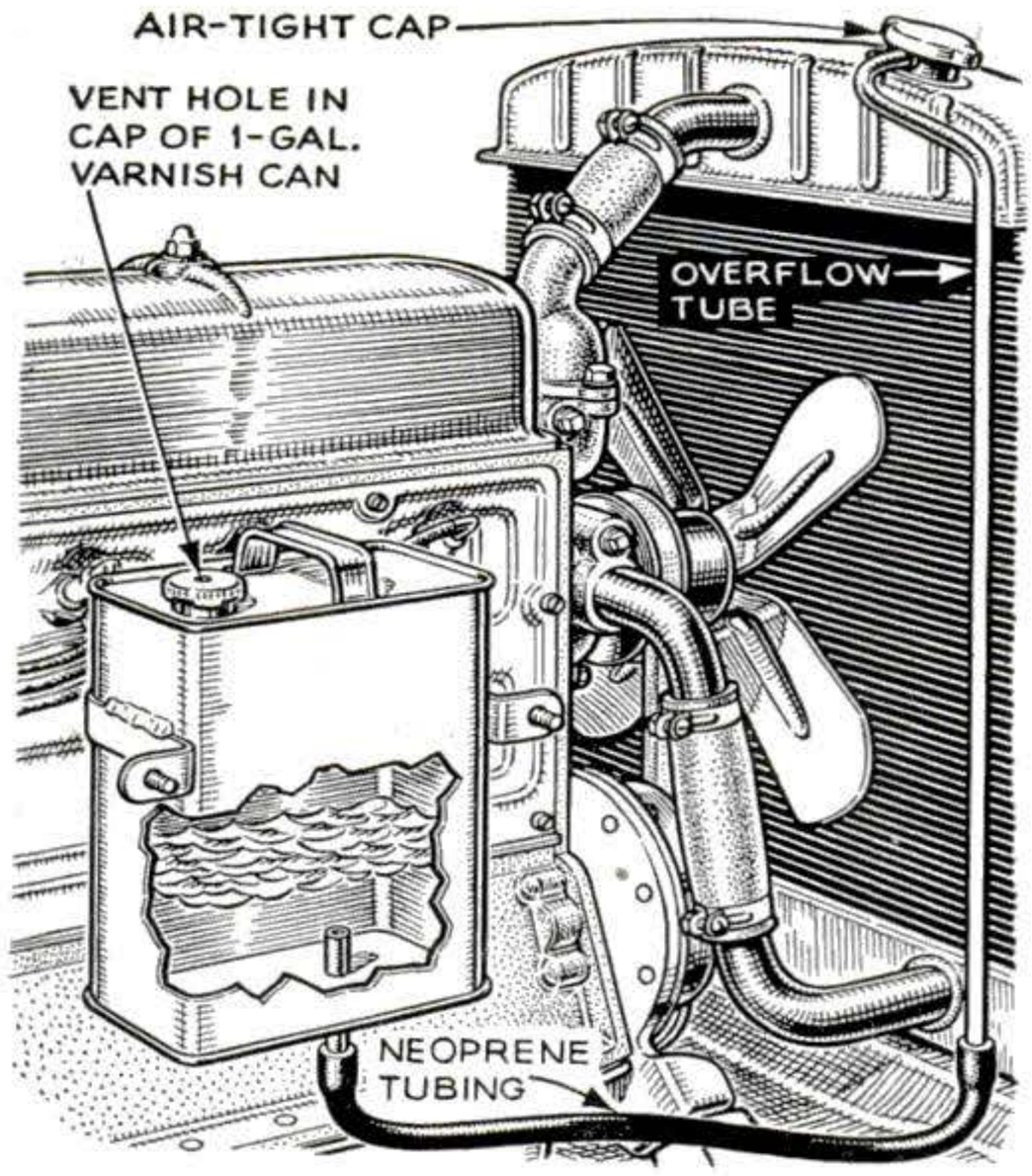
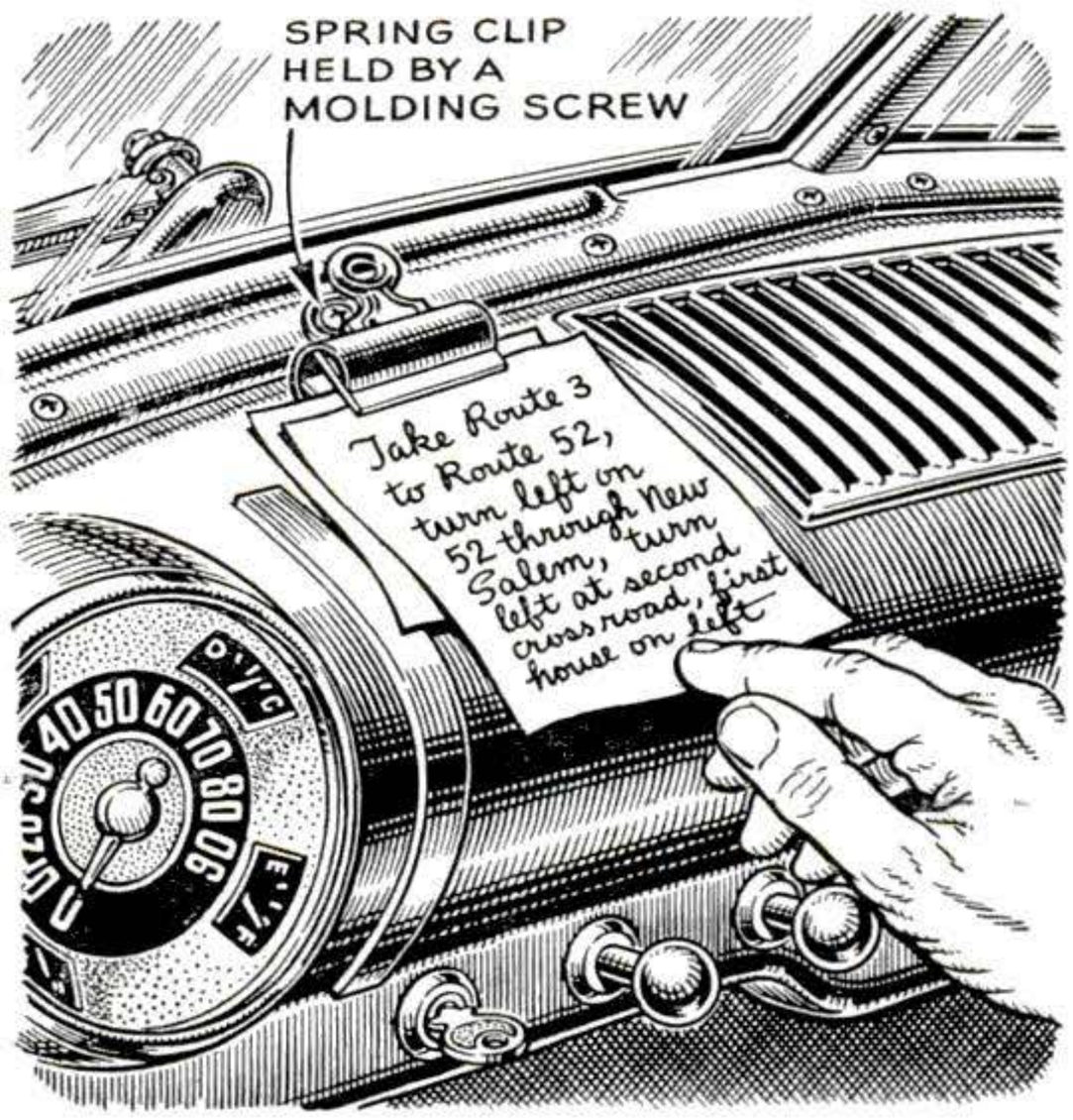
MORE Hints from the Model Garage



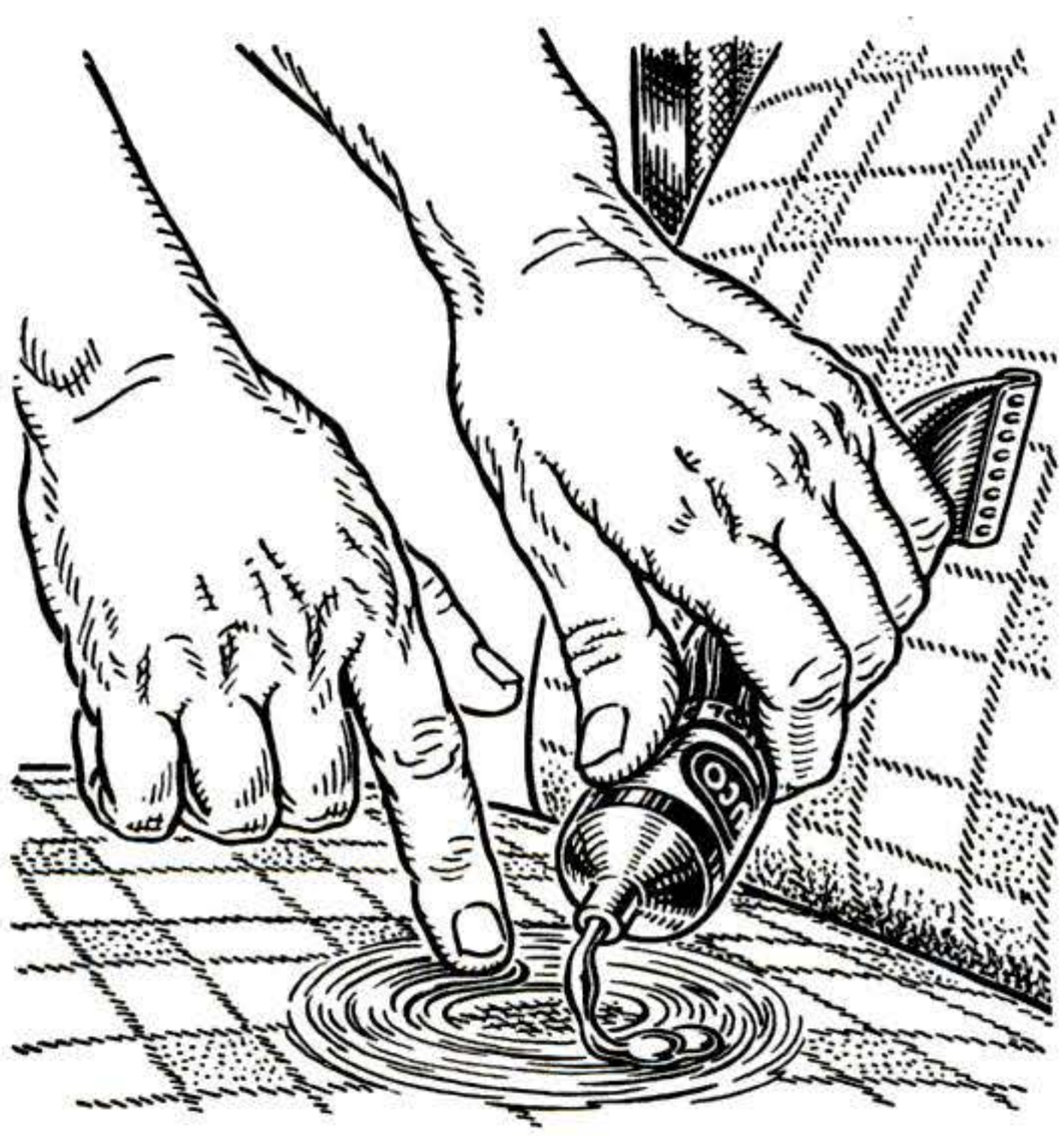
Finding a Noisy Lifter. A noisy hydraulic valve lifter can be located by removing the rocker-arm cover and resting a finger on each valve-spring cap in succession while the engine is idling. If any lifter isn't working properly, you'll feel a distinct shock in your fingertip when the valve returns to its seat.



Save Your Antifreeze. In cars with atmospheric cooling systems, you can lose alcohol antifreeze through the overflow pipe when the engine runs hot. A tank like this will save it. Boiled-out alcohol will condense in the can. When the engine cools, vapor in the radiator will condense, sucking alcohol back from the can.



Clip Will Hold Notes. An ordinary spring clip mounted like this makes it easy to keep notes in sight while driving. Remove one of the screws from the windshield molding, slip it through the eye of the clip, and replace in the molding.



Cement Saves Seat Covers. If seat covers are about to wear through, apply a thin coat of Duco cement on and around the worn area. D. Earl Chase, of Long Beach, Calif., says he has extended the life of covers a year or more by this trick.

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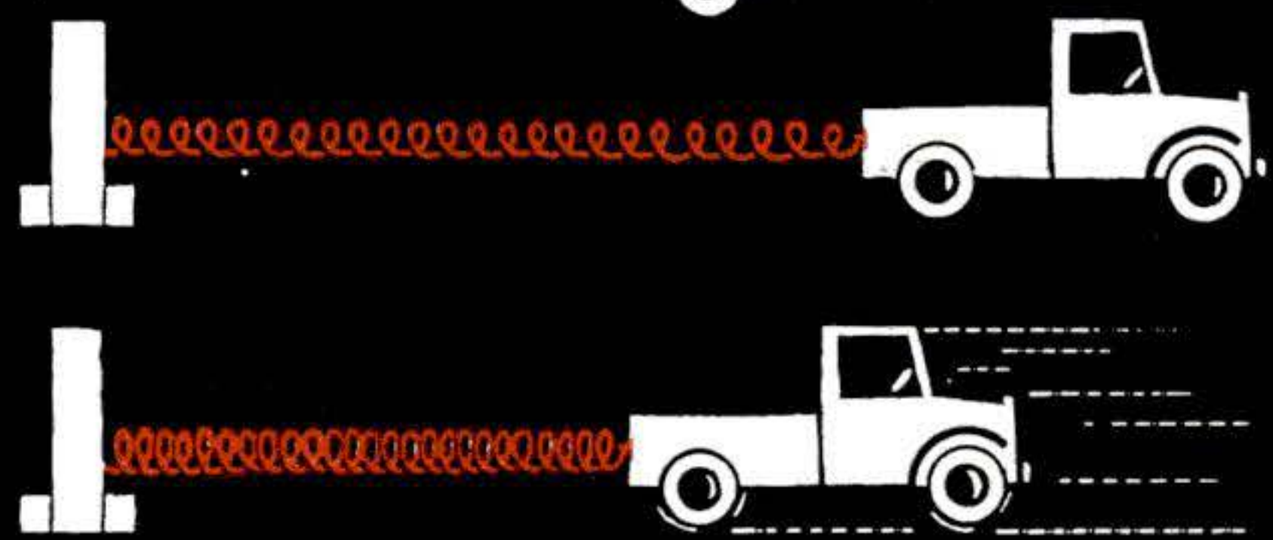
Friction Helps You Drive

On a highway, static friction between tires and road gives you traction. But look what happens on an icy road when the tires slip and you obtain only sliding friction. Hook a light coil spring to a wind-up toy auto and let it run forward on a smooth surface, stretching the spring. As soon as the wheels spin, the spring will yank the toy backward because they have lost traction. On icy roads you have the greatest traction just before wheels begin to spin.



What it does is easy to demonstrate, but even the experts don't know exactly what produces it.

By Kenneth M. Swezey

CHANCES are you think of friction in your car as something to be gotten rid of. Yet without friction, your car couldn't start, keep going, or stop!

In the moving parts of your engine and transmission, friction is a costly trouble-maker that must be reduced through lubrication. But brakes, clutch, and the moving and maneuvering of your car over the road all depend upon friction.

Much still remains to be learned, the scientists say, about what causes friction. It has been ascribed to the intermeshing of surface irregularities, the action of molecular forces, harder projections plowing through softer ones, and electrostatic forces. Many experts believe now that all four factors are involved, but think that molecular forces play the major role by causing adhesion or cohesion of the surfaces.

Despite the uncertainty as to the reasons for friction, the way in which it helps your car stop and go, and how it makes smoother, safer driving possible when properly controlled can be shown convincingly with stunts you can perform at home.

Rough surfaces usually produce more friction than smooth; solid surfaces more friction than liquid. Tack a piece of coarse cloth on one side of a board about 8″ wide and 18″ long, and a piece of smooth cardboard on the other. Place a flatiron near one end of the board, and raise that end slowly until the iron begins to slide. You can raise the board higher when the iron is on the side covered by rough cloth than when it is on the smooth side.

Now turn over the board, smear the cardboard surface with cooking oil, and try your test again. This time the iron quickly starts sliding down the board.

Manufacturers use this principle in adding or reducing friction in your car. Where high friction is needed, as in brake linings, clutch facings, and fan belts, rough materials such as asbestos, cotton, rubber, and plastics are used. Cylinders, pistons, shafts, and bearings, on the other hand, are polished to mirror smoothness, and lubricated with oil. Properly lubricated surfaces do not actually

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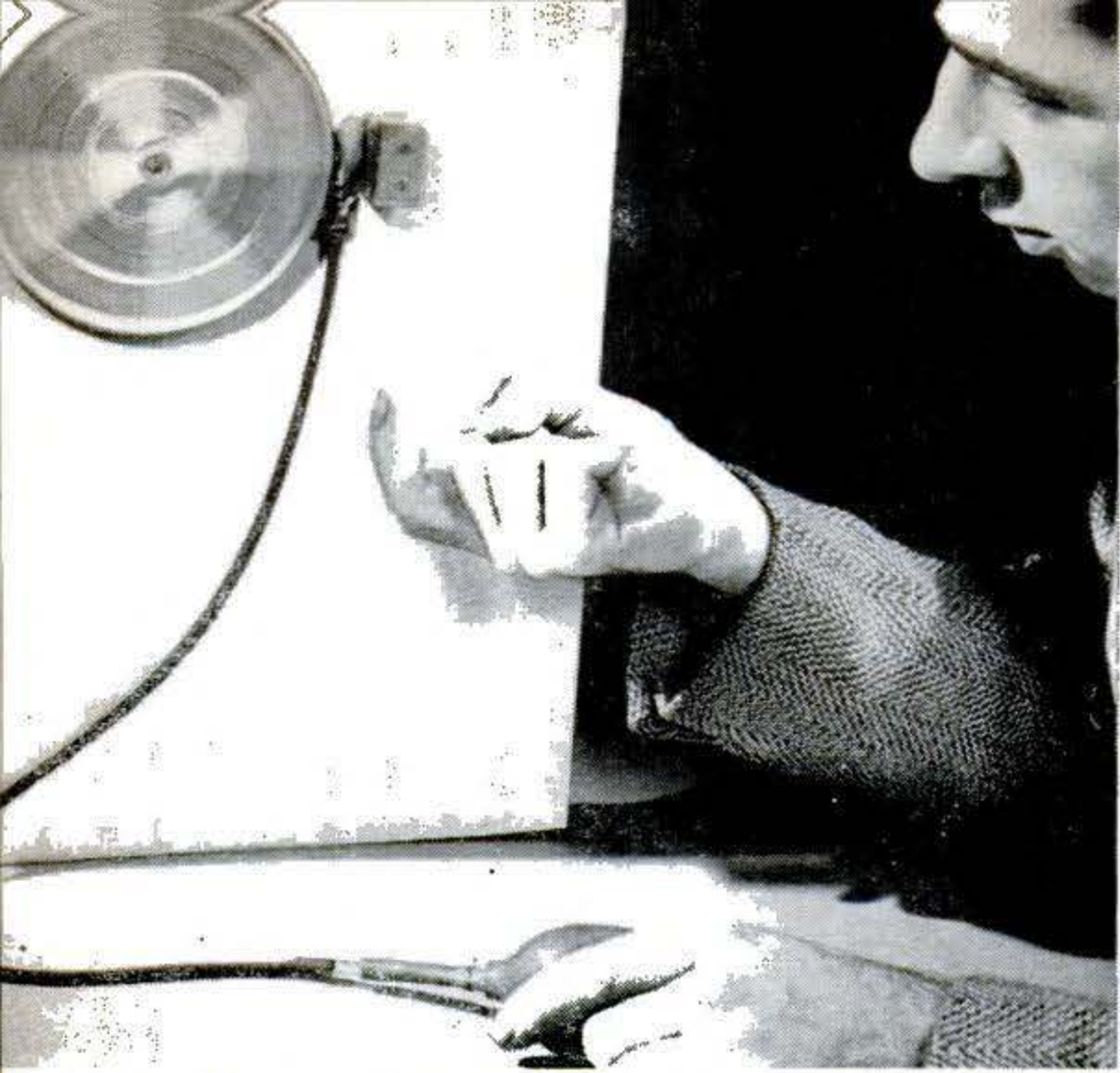


Modern hydraulic brakes are imitated in this setup. A small balloon (to represent a brake cylinder and friction surface combined) is tied to one end of a thin rubber tube, and an atomizer bulb (to represent the master cylinder) to the other. The balloon is then fastened to a board so that it fits loosely between a small block of wood and a coffee-can cover (the brake drum). The cover is mounted at its center so it can spin freely. If you now spin the cover without pressing the bulb, the limp balloon will not interfere. Press the bulb, however, and the balloon inflates, presses against the cover and quickly stops it. If liquid were in the bulb, balloon and tube, as in the hydraulic system of your car, the transmitted force would be still more powerful, since liquids don't compress the way air does.

touch solidly but slide on a thin film of oil.

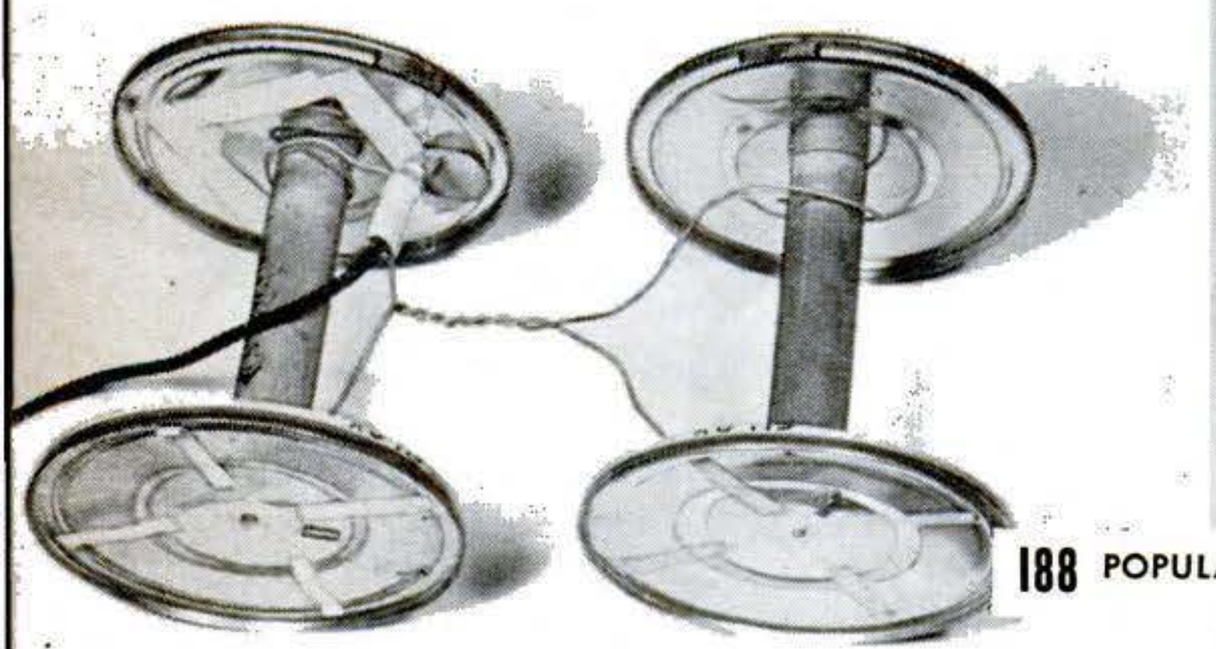
There is a second principle of friction that every car driver should know: that *friction is greater when surfaces are motionless in relation to each other* (static friction) *than after they start to slide* (sliding friction).

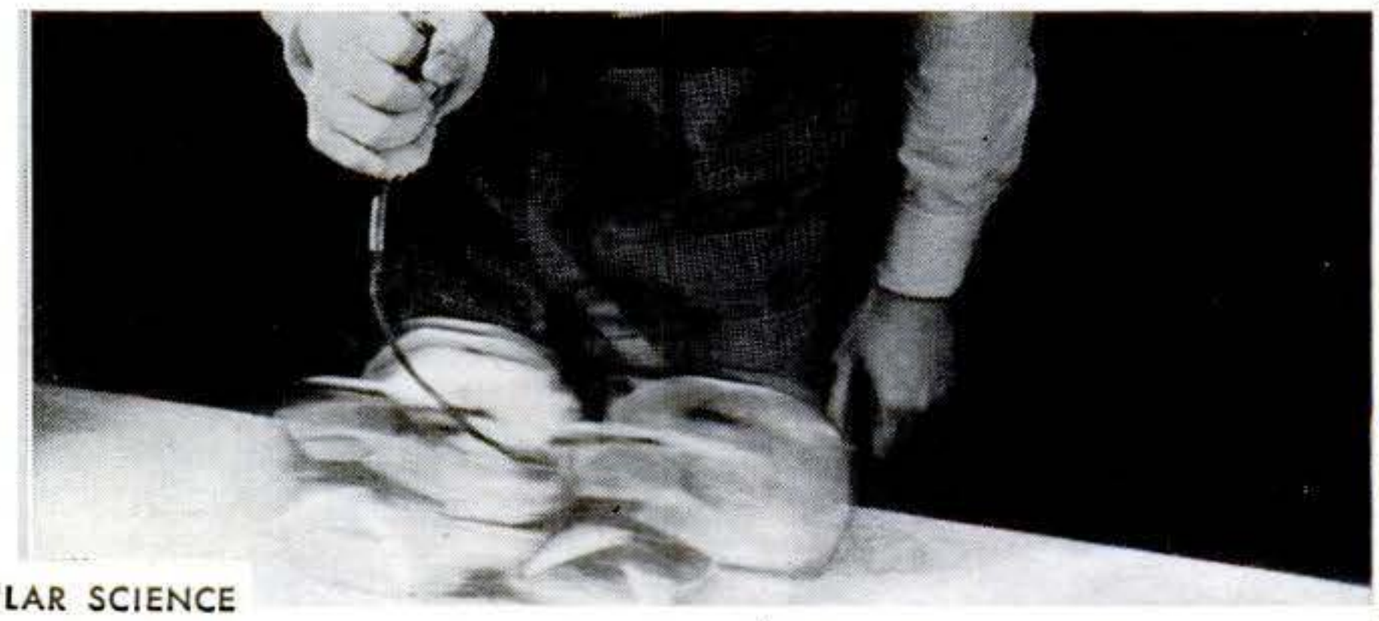
To demonstrate this, try dragging your flatiron over a smooth, firm surface by means of a spring scale. Begin with the iron at rest, and pull steadily. Read on the scale how hard you have to pull before it stirs. Then pull the iron along at an even rate and see how much less force is needed. That's because in the first case you're pulling against static friction; in the second, only against sliding friction.

When you start your car on an icy road, you get the greatest pull from the wheels when held by static friction, just before they start to spin. You can minimize spin by using high or second gear, rather than low, and by gentling the gas pedal.

In your brakes, powerful friction is applied by liquid pressure remotely controlled. Pressure on the brake pedal causes liquid pressure to develop in a master cylinder. Through tubing, the pressure of the liquid is transmitted equally to smaller cylinders in the brake mechanisms of each of the four wheels. These small cylinders cause friction linings to bear firmly against drums or disks fastened to the wheels, slowing the car.

Best way to use your brakes can be demonstrated by making a crude car like this. Nail coffee-can covers firmly to the ends of two 6" lengths of broomstick or shade roller, and connect them with a chassis of stiff wire. Tape the balloon end of the "brake" used in the setup at top of page to the wire so that the balloon when inflated will press against one of the rear wheels. Adhesive tape on the inner side of this wheel will increase the friction.





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Whether a car rolls or skids to a stop is another problem of static versus sliding friction. As long as the brakes can slide on the drums, the wheels will keep a firm grip on the road; if the brakes should lock, the wheels must slide. To stop your car in the shortest possible distance without skidding, you must apply the brakes until they are just short of locking. In that situation, brakes exert their maximum retarding force.

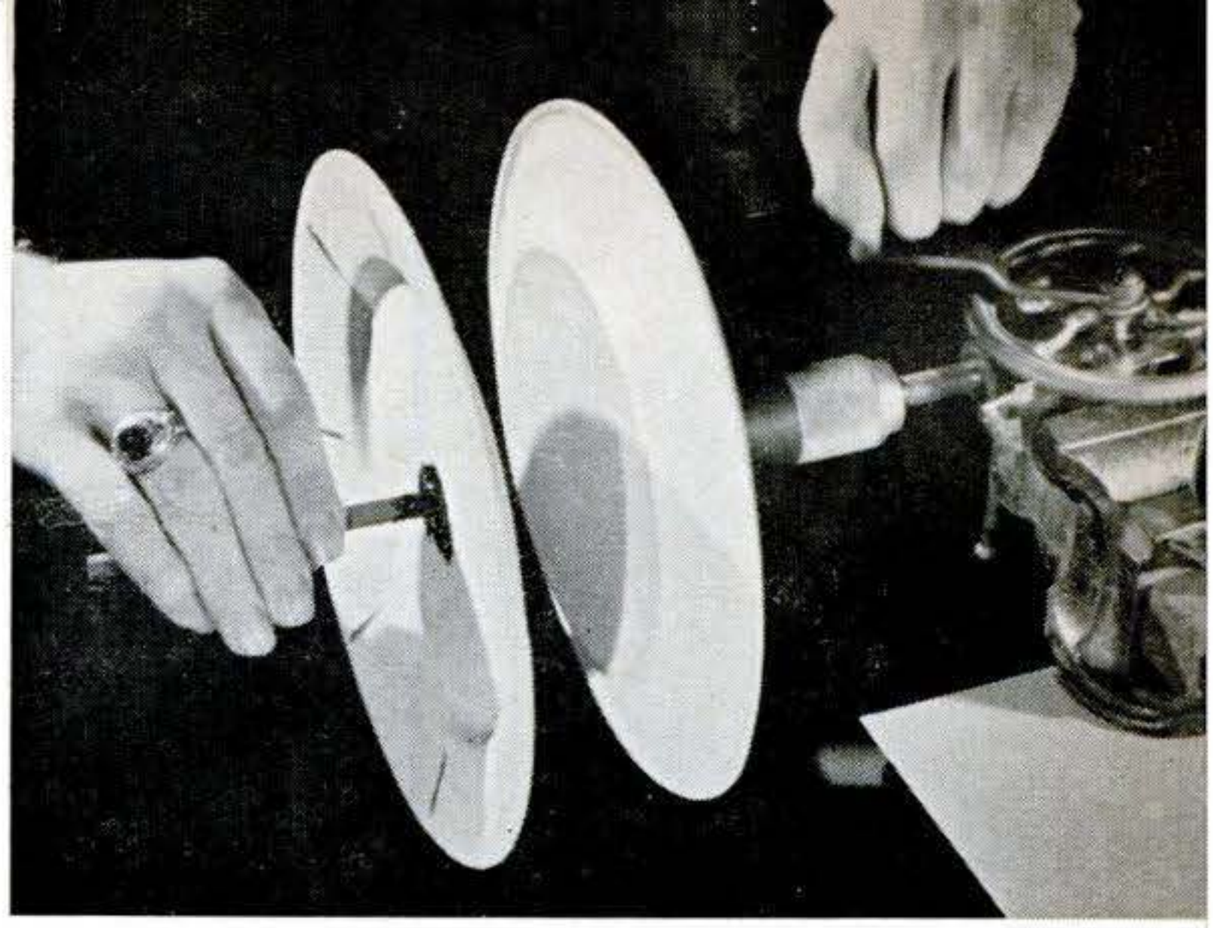
Your clutch also depends upon friction, either solid friction as in the conventional clutch, or fluid friction plus inertia as used in the fluid variety.

Even Fluid Clutch Uses Friction

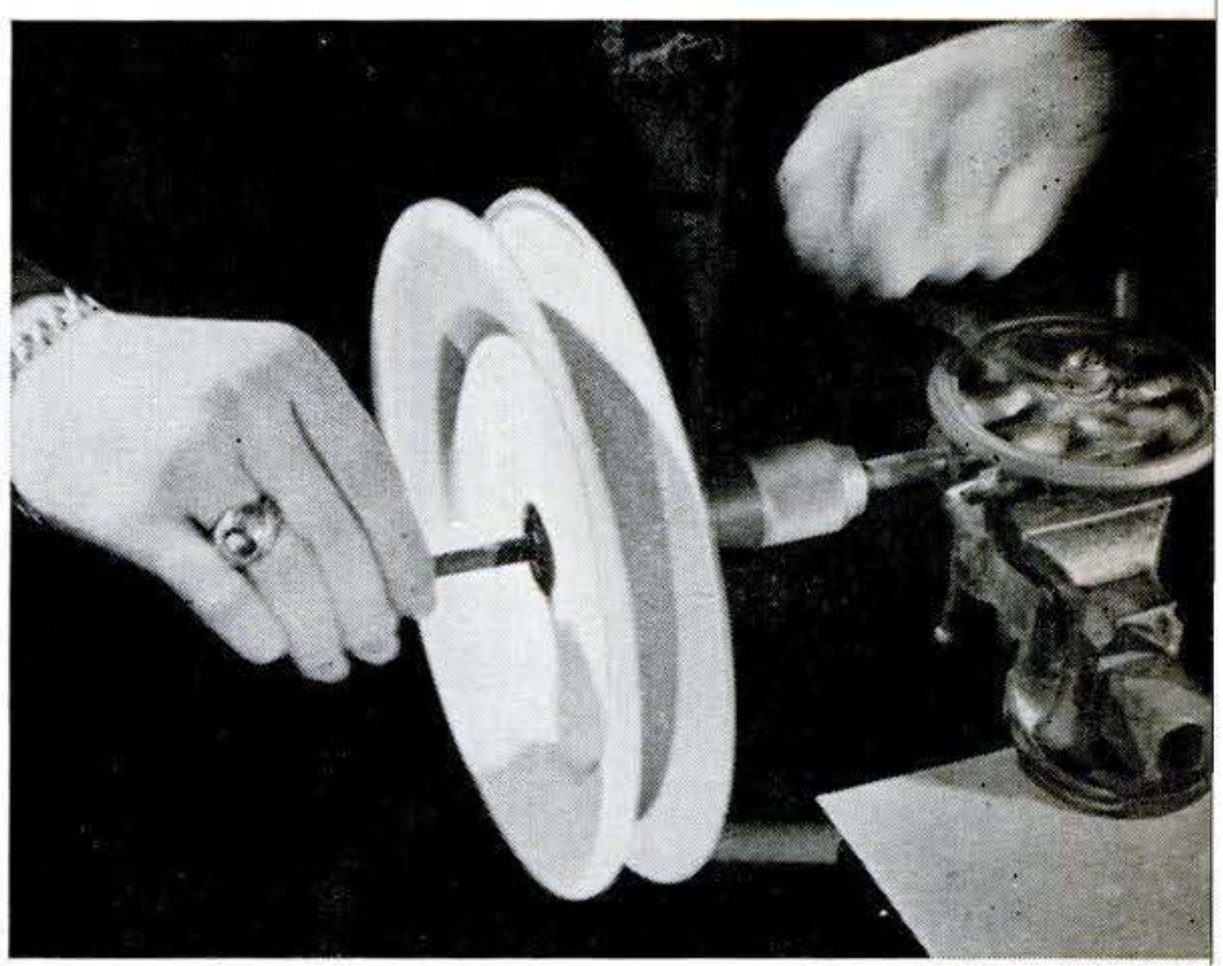
The fluid clutch depends in part upon the friction of a fluid, whirled by an impeller wheel, upon a similar wheel that faces it. With two electric fans, set face to face, you can get an idea of how it works. Only one fan (the impeller) is plugged in. Set this going at slow speed (engine idling) and the friction on the other is not enough to turn it. Turn the impeller to high, and the second fan builds up speed smoothly until it is running almost as fast as the first.

What becomes of the energy absorbed by friction? It is changed to heat. You can easily prove it. Tightly plug the lower end of a ⅜″ brass tube 3″ long, and grip it in the chuck of an electric drill or flexible shaft, mounted vertically. Partly fill the tube with water and cork the upper end. Now set it spinning between the jaws of two stationary spring clothespins clamped on it. Within several minutes the heat of friction will boil down the water and pop out the cork!

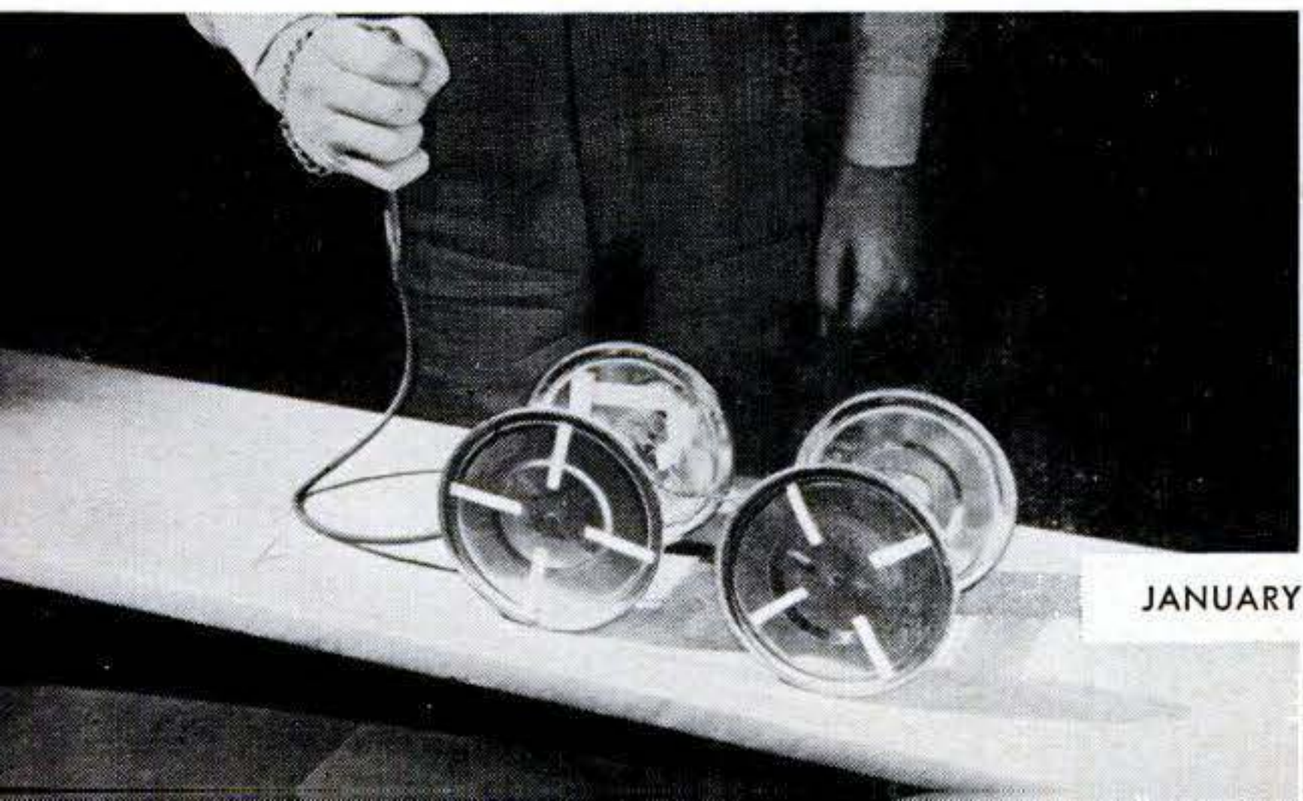
In the normal operation of your car the heat of friction is dissipated as fast as it is created. If you "ride the clutch," or use the brakes continuously, however, this heat may burn out the clutch or brakes. END

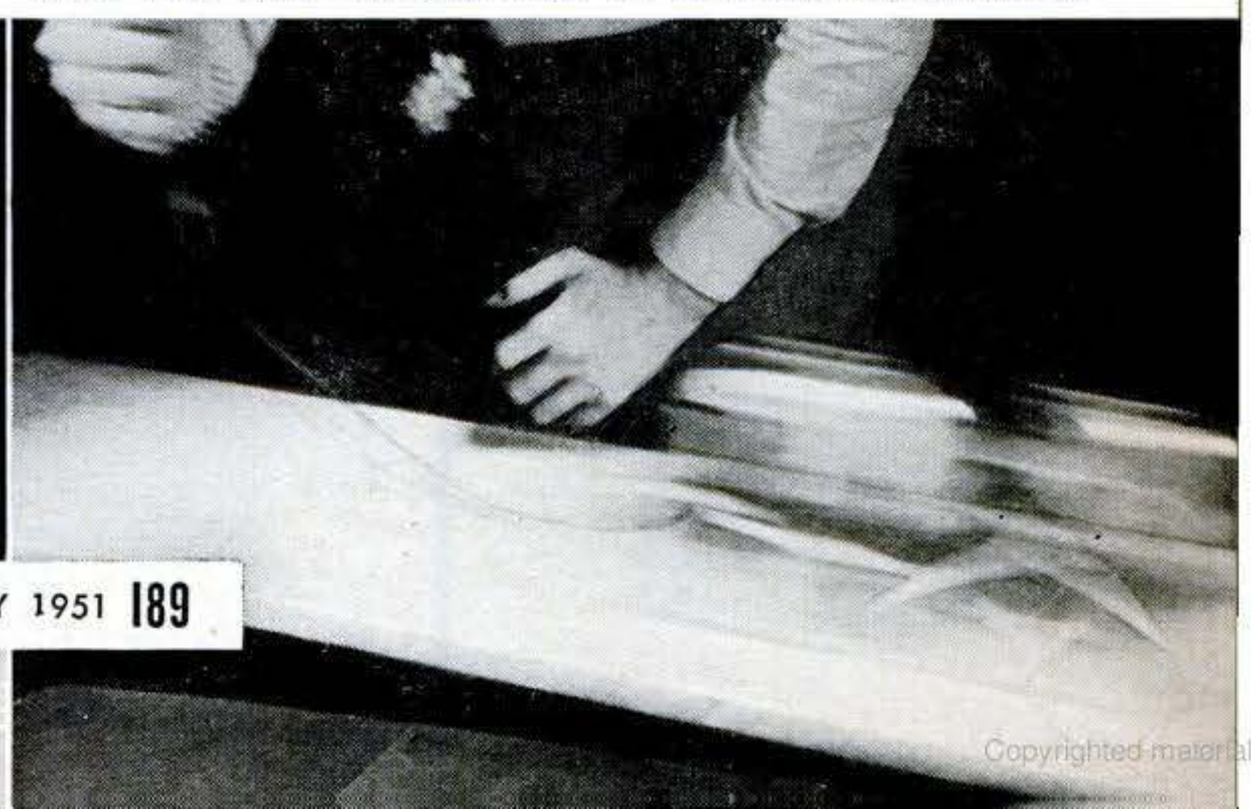


Principle of common clutch involves friction, too. Attach round pencils by means of sealing wax to the center of each of two paper plates. Rotate one plate with a hand drill while holding the other parallel to it but not touching, above. The rotating plate represents the engine flywheel, the other plate the clutch connected to the transmission. When you press on the clutch pedal in a car, the plates are separated, permitting the engine to run without engaging the transmission. Bring the plates gradually together, however, the way they do when you let up the clutch pedal, and friction between the plates causes the second plate to start turning and gain speed until it is revolving at the same speed as the first one, below.



Roll the car down a smooth inclined plank and you'll find that you can make it roll as slowly as you wish, or stop smoothly, by controlling the pressure on the bulb in your hand. Let the car gain speed, and then apply pressure strongly and suddenly, however, and what happens? The rear wheels lock and the car skids out of control down the road. Locking wheels not only lessens effective stopping friction but also causes loss of directional control.





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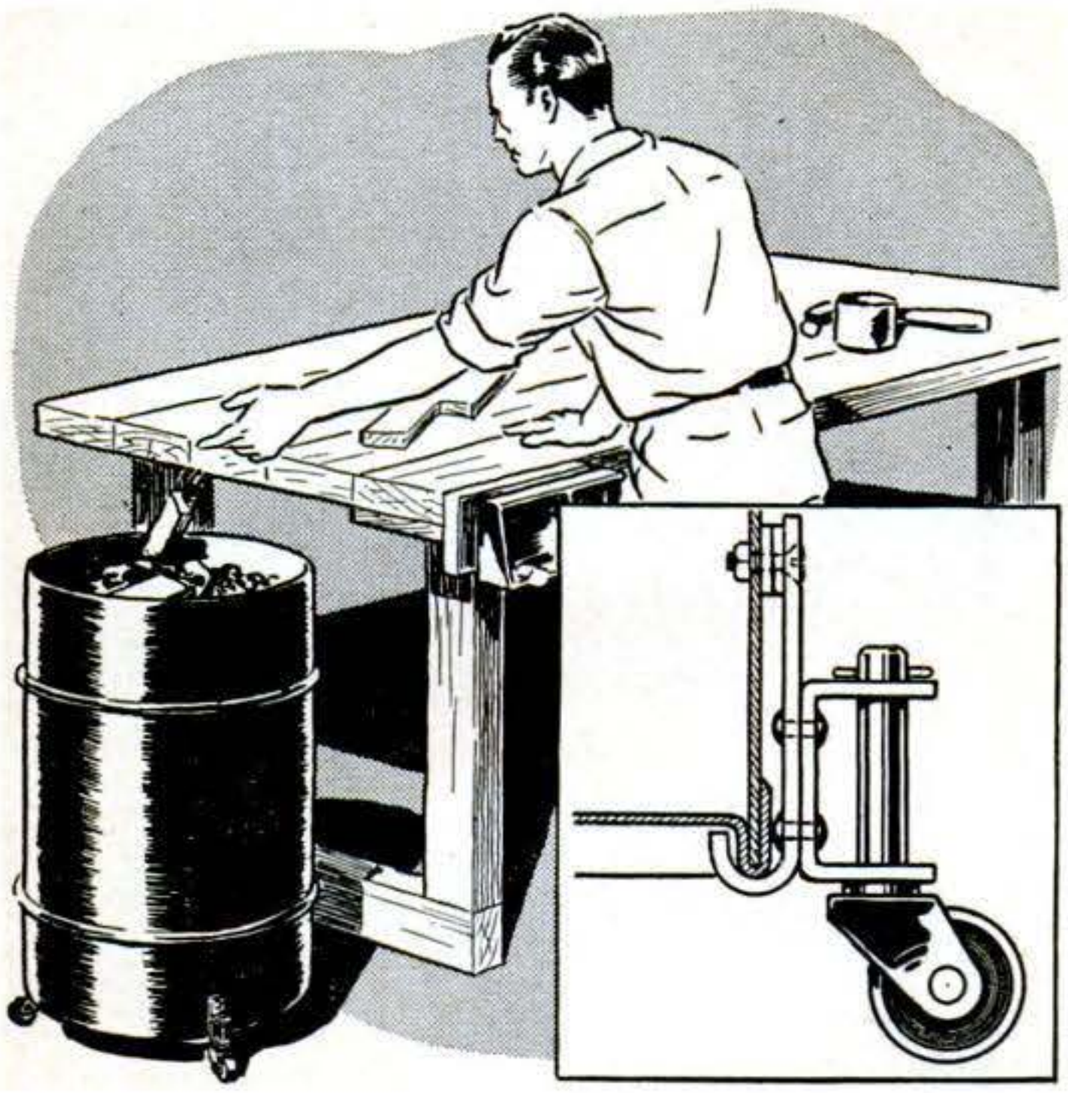
This Waste Bin Rolls Freely Around Your Shop



AN OLD oil drum makes an ideal waste container if casters are attached to allow it to be rolled about. Insert each caster in a bracket of 3/16″ by 1″ strap iron, riveted to a leg bent to hook under the drum. A single screw or rivet will hold each wheel assembly on the drum.—*Jesse R. Lucas, Michigan City, Ind.*

You Don't Have to Lick 'Em

AN EMPTY spot-cleaner bottle with applicator top makes an excellent envelope sealer when refilled with water. It's handy for children to use, too, in playing with mucilage-backed cut-outs.—*Jensen Malley, Rutherford, N. J.*

Brighten the TV Tuning Knob

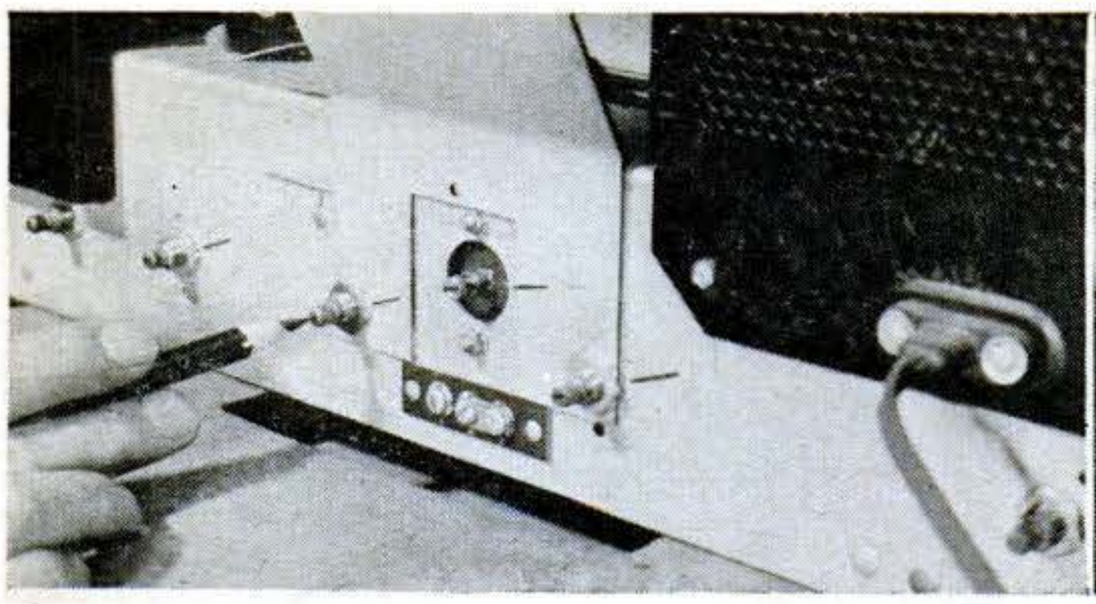
INDICATOR knobs on TV sets often have white dots or lines by which they can be indexed on the channel-selector dial. If the dot or line on your set becomes indistinct, you can sharpen it up and make it more visible in dim light with a little white touch-up paint. Apply it with a brush, pen, or orange stick.—*H. Leeper, Canton, Ohio.*

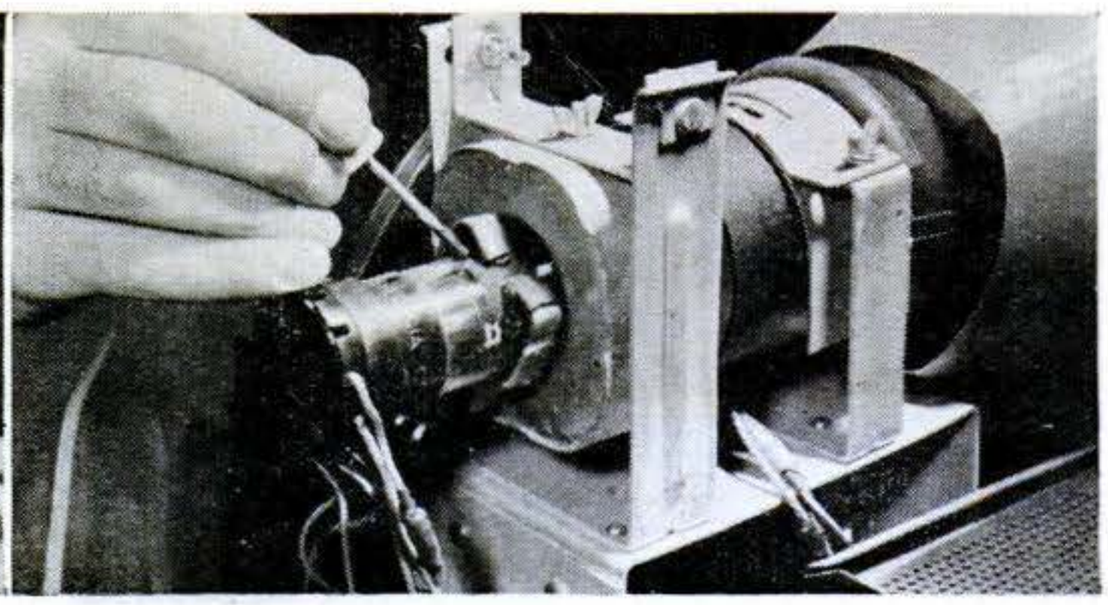
Homemade Brush Does Painting Jobs

FOR small touch-up painting jobs, you can quickly make a disposable brush. Fold a small piece of cloth lengthwise several times and attach it to a stick of wood with a string or rubber band. —*Louis Hochman, Sherman Oaks, Calif.*

Marks Make Readjusting a TV Receiver Less Risky

VIBRATION, age, and other factors may whittle away the quality of your TV picture. In many cases, however, you can restore top performance by careful readjustment of the back-of-the-set controls. Changing their setting, however, may also throw a receiver completely out of adjustment. If you'd like to try sharpening your reception but are afraid of the consequences of a bad job, mark the position of each control before you start. You can then be sure of being able to restore it to its original position if the new setting doesn't help. Pencil an index line on the control shaft and a corresponding line on the chassis. To locate the ion-trap magnet, use nail polish or a grease pencil.





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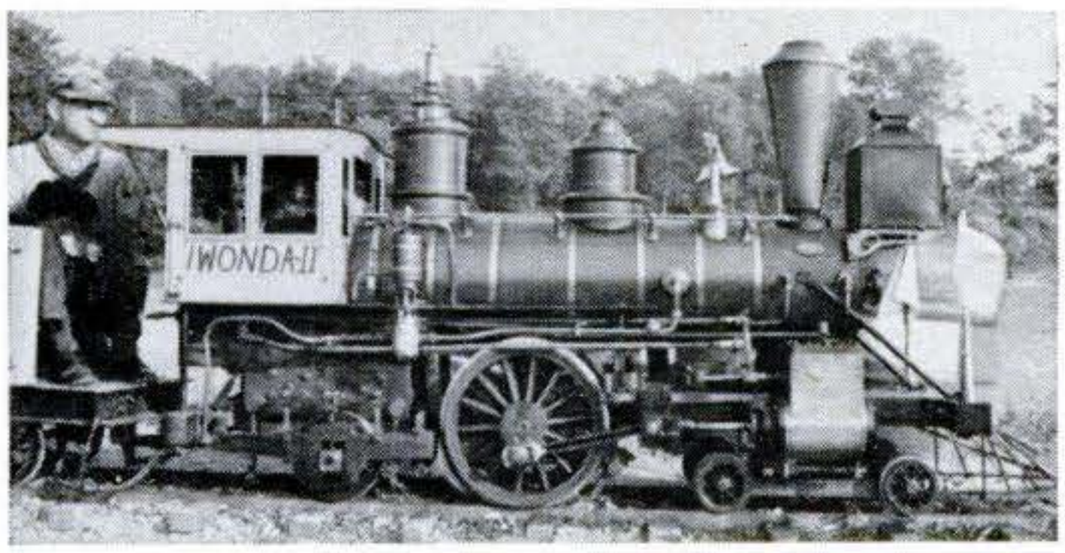
CRAFTSMEN AT WORK

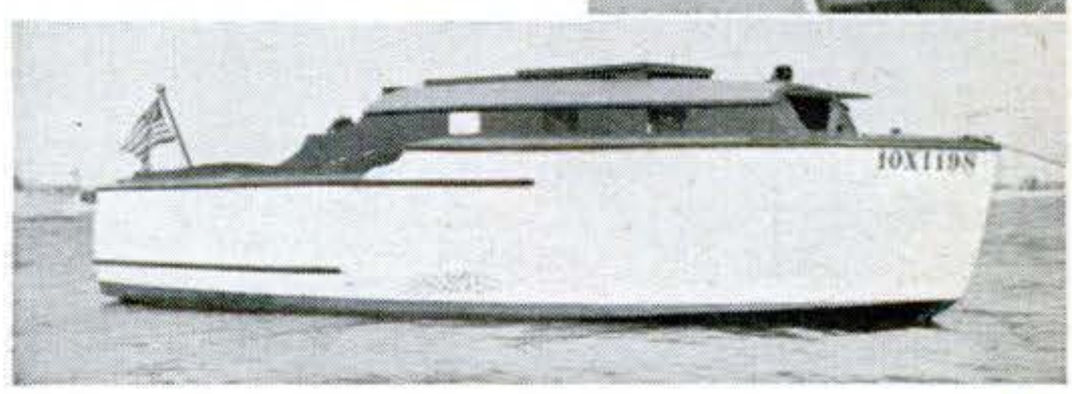
Model Tugboat Is Radio-Controlled. James Emel, skipper of an Army tug at Seattle, Wash., holds a model he and his brother, Jack, built. Scale is ⅜″ to 1′. The 48″ model tug weighs 50 lb., does 4½ knots, and is driven by a 6-volt, battery-powered motor. A radio receiver in the wheelhouse picks up impulses from a hand-carried transmitter to control the model. A motorcycle battery runs the boat for about 1½ hours.



Builds a 2,400-Lb. Locomotive. Donald Benoit, a Norwood, R. I., machinist, built this oversized model of an old 4-2-2 locomotive. He spent about 6,000 hours over a 4½-year period working on the engine. The boiler builds up 100 lb. of steam. Benoit says the engine could go 40 m.p.h. if there were enough straight track. He has one third of a mile of track at Hamilton, R. I.

Camera Stops Rental Thefts. The photo below shows you what the customer sees when he rents equipment from Lyn Grover, Glendale, Calif., photo dealer. Each rental customer is photographed by a 35-mm. camera. A foot switch controls the 150-watt light. A cable release snaps the picture and an automatic transport moves the film for the next exposure. Grover says he has not lost equipment since he began "mugging" borrowers.

7½-Hp. Motor Runs Cruiser 9 M.P.H. William C. Miller, Jr., of Oceanside, N. Y., who built this 17′, 6′2½″-beam cabin cruiser from PS plans, also made the quadrant to permit remote steering from a wheel in the cabin. The quadrant clamps to the carrying handle of the outboard motor by two wing nuts. Throttle and shift controls also are at the wheel. The builder says that the boat cruises from 7 to 9 m.p.h. He has seen seven other boats built from the same plans.



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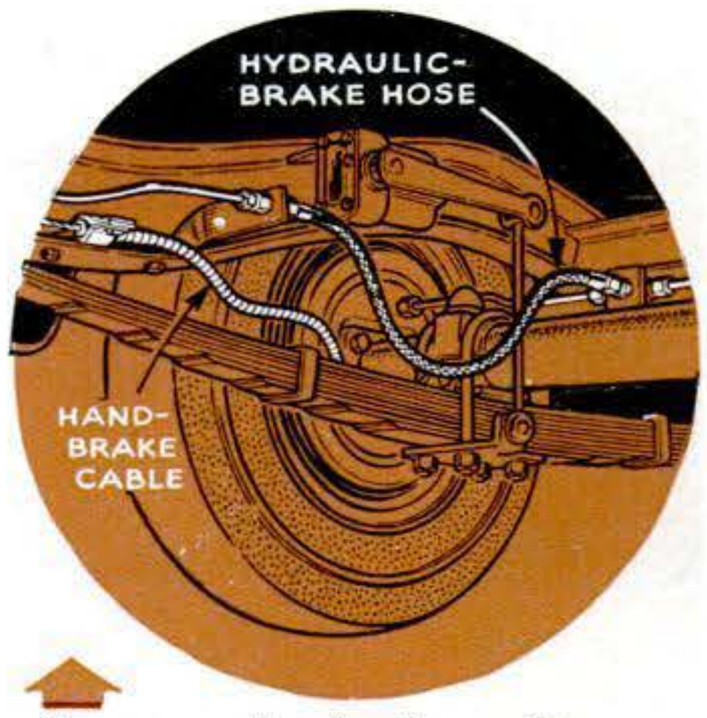
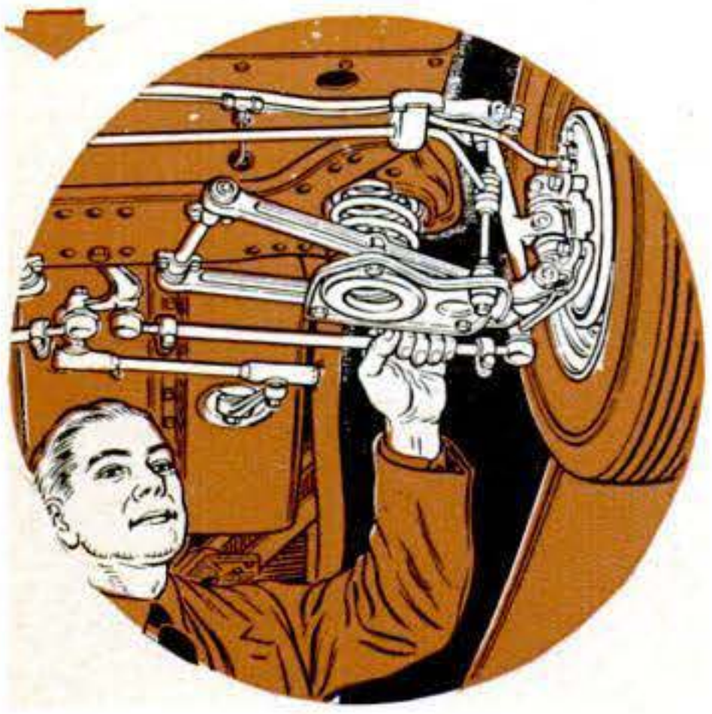
While Your Car Is on the Grease Rack

GIVE it a worm's-eye checkup. The best mechanic can easily miss trouble coming. You may find it if you always use your few minutes of waiting time for under-car inspection. It's a practice that not only may save you money but also may save you from a serious accident.

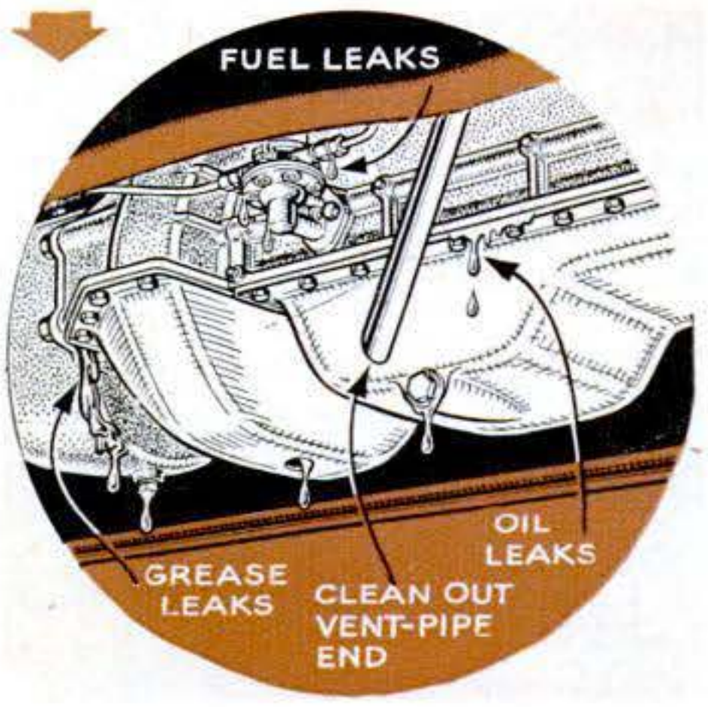
Check the steering gear for dangerous looseness by vigorously shaking all parts. Test the tie-rod ends with extra care. Grasp wheel at bottom and shake to see if king pins are worn. Be sure all cotter pins and locknuts are okay—and that no parts are cracked or bent.



Look for leaks that waste gas and oil. Oil may drip from edge of pan or out hole in bottom of clutch housing. Test transmission and differential plugs for looseness. Slip a screwdriver into the vent pipe. It sometimes gets clogged. Also check engine mounts.

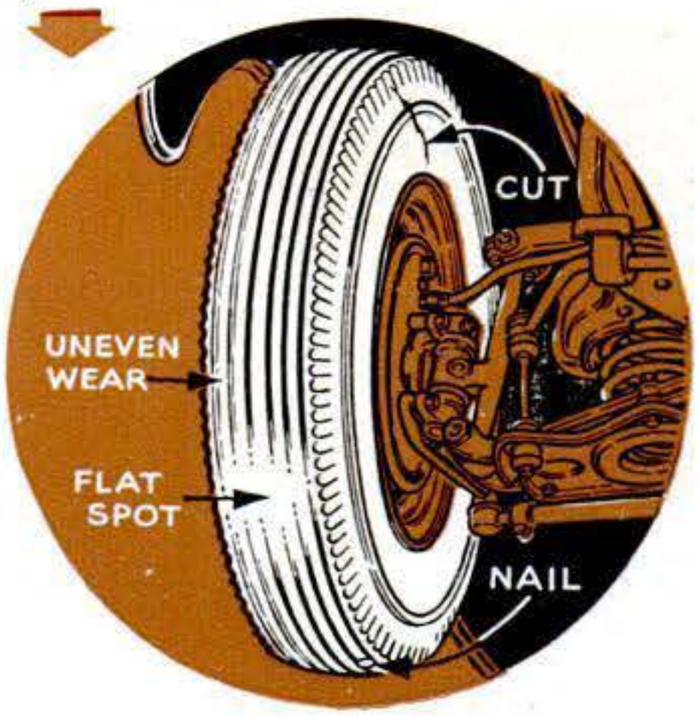


Inspect the brakes. Examine the hose and fittings at the ends. Check master cylinder if visible. Make sure handbrake cable is secure. Look for oil dripping from lower edge of brake drums —sign of a defective oil seal.



Go over the tires. You won't have a better opportunity to locate embedded nails or tacks, cuts, and the uneven wear that comes from improper wheel alignment. Wipe off any grease or oil you find on tires.

Check exhaust system. See that muffler and pipes are mounted securely. Examine muffler for rust holes and explosion ruptures. Slap it sharply to see whether the baffles have worked loose. Be sure tailpipe isn't bent or badly flattened. This can cause serious loss of power.



Examine springs for signs of broken leaves or failing shackles. Inspect the shock absorbers for worn linkages and fluid leakage. Shaking propeller shaft may reveal loose universal joints. Be thorough; the inspection affects both your pocketbook and your safety.

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A Well-Strained Diet Saves a Car's Engine

You must clean the cleaners regularly if you want them to keep out dirt. Here are tips on how to go about it.

By R. P. Stevenson

YOUR car's engine will give you more economical service and last much longer if you make sure abrasive grit and dust particles are strained from the air, oil, and fuel on which it feeds.

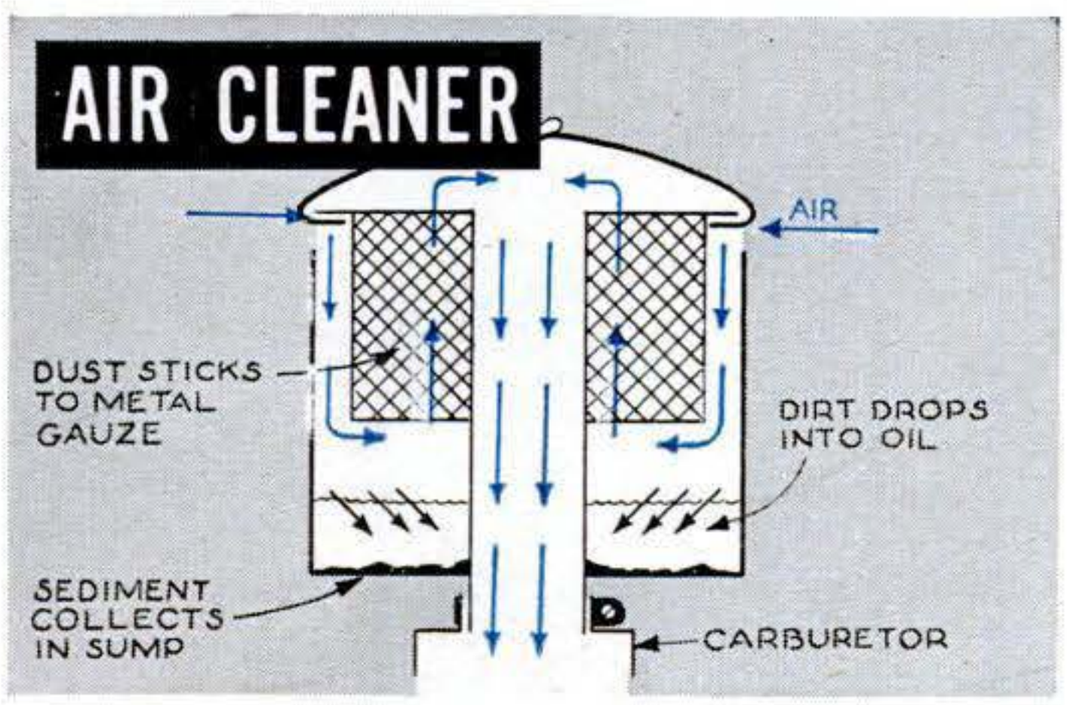
Air cleaners, oil filters, and gasoline strainers are installed to do this. But they must be cleaned regularly to do it well.

An engine usually has at least two air cleaners. One filters the air sucked into the carburetor. A second (and sometimes a third) keeps dust out of the crankcase. Under ordinary conditions, washing and oiling these cleaners each time you change oil is sufficient. But in extremely dusty regions, it pays to give all of them much more frequent attention.

An oil filter is not always standard equipment, but increased engine protection warrants the extra cost. Your money will be wasted, however, if you delay changing the filter cartridge, letting dirt clog it up. In some new cars, by-pass filters are giving way to the more efficient full-flow type.

Because some deposits are insoluble in kerosene or gasoline, garages often use special solvents for washing air and fuel filters. But if you want to do the job at home, kerosene or gasoline will usually produce good results.

The photos below and on the next two pages show you how.

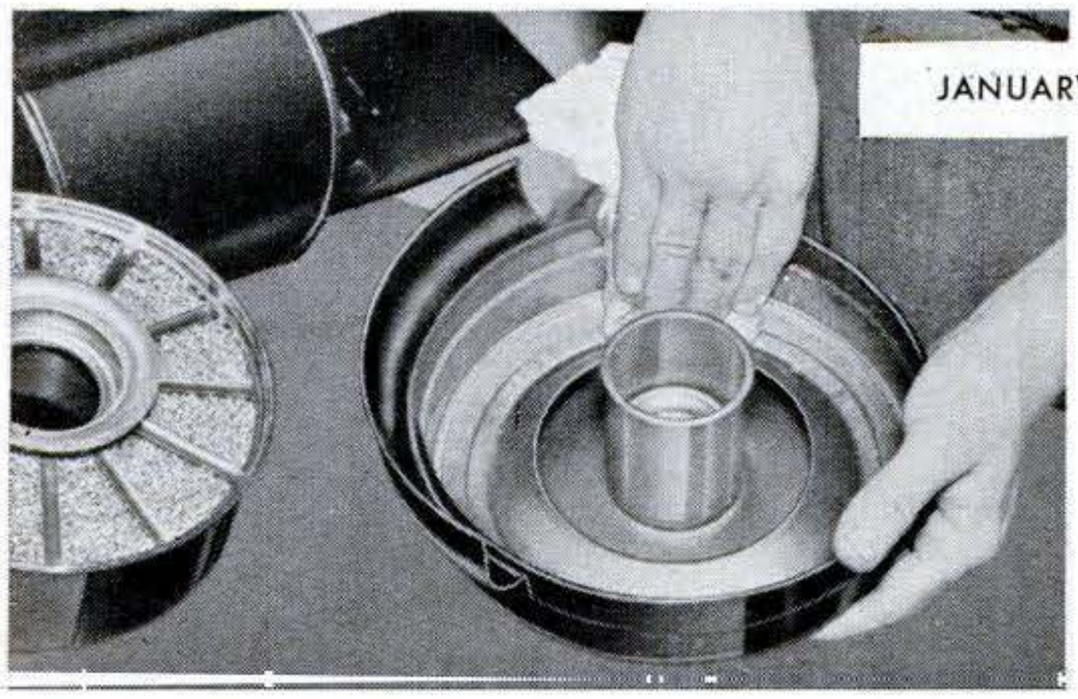


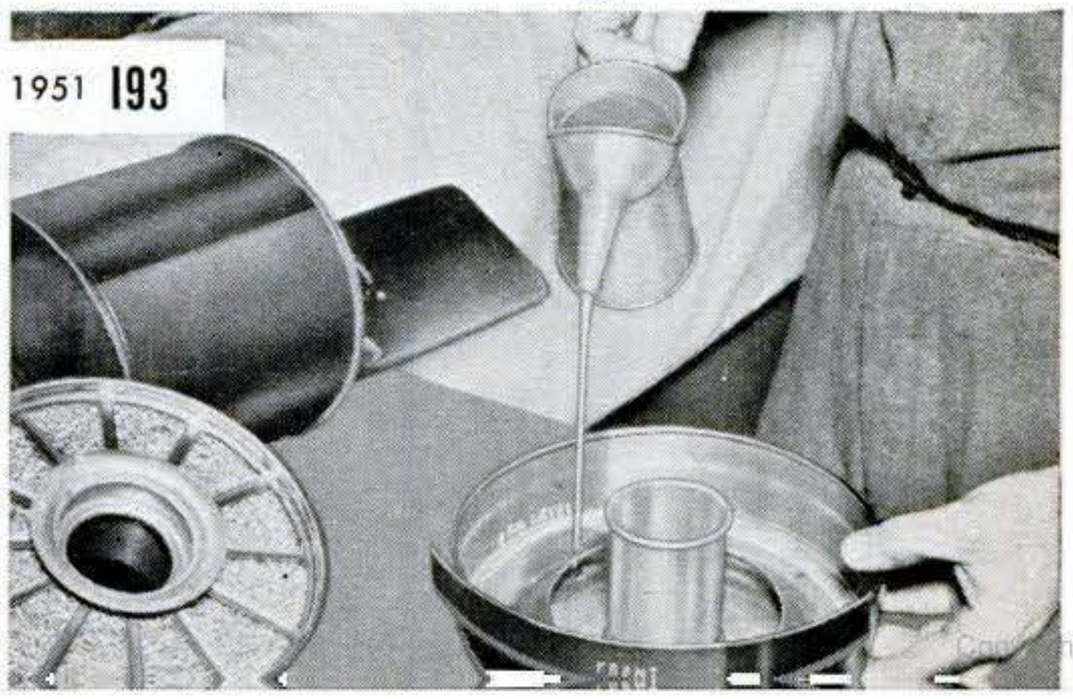
Why it needs cleaning. Air drawn through an oil-bath cleaner (above) suddenly reverses direction, causing heavy dust to fall into bath. Lighter particles may continue—but the oily gauze stops them. A "dry" type cleaner has no oil sump; gauze then does all the filtering.

Wash filter element in solvent. Then set the element aside to drain until dry. Mechanics often use an air hose to dry it, but one car maker now discourages this because the blast may mat the mesh together and retard the flow of air. If element has a gasket, clean it well.

Wipe sump dry with cloth after first pouring out dirty oil (from oil-bath type) and washing the sump with solvent. For best results, check your cleaner each 1,000 miles under ordinary driving conditions. If yours is the oil-bath type, service it at once if the sump fills with a thick mixture of dirt and oil.

Pour oil into sump of oil-bath type as below. Never fill above indicated level. In dry type, dip element into oil and let it drain. Don't oil gauze element of an oil-bath cleaner; motion of car will do this. Most car makers specify S.A.E. 50 oil for cleaners in summer, 20 in winter, but some recommend a lighter grade.





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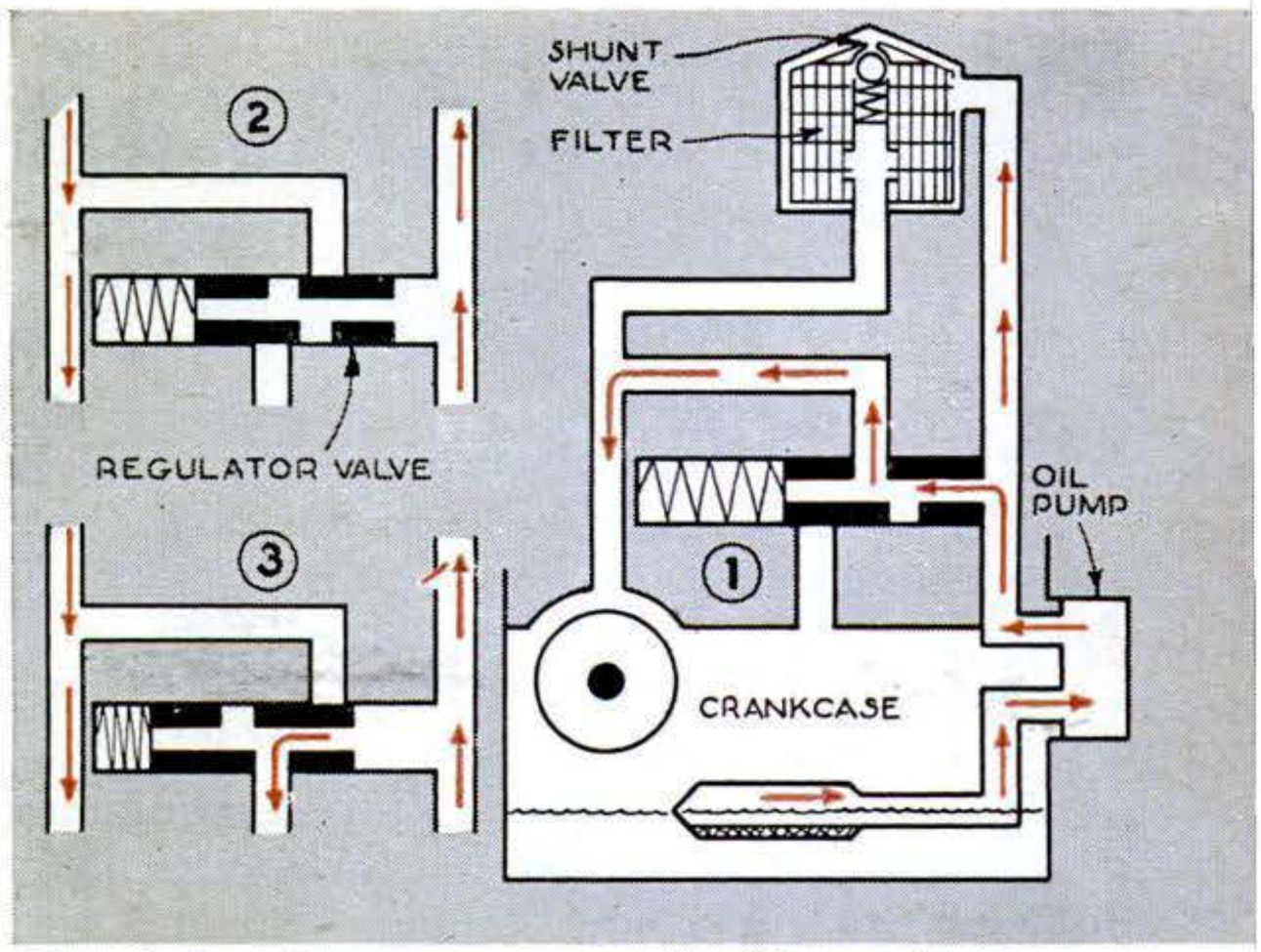
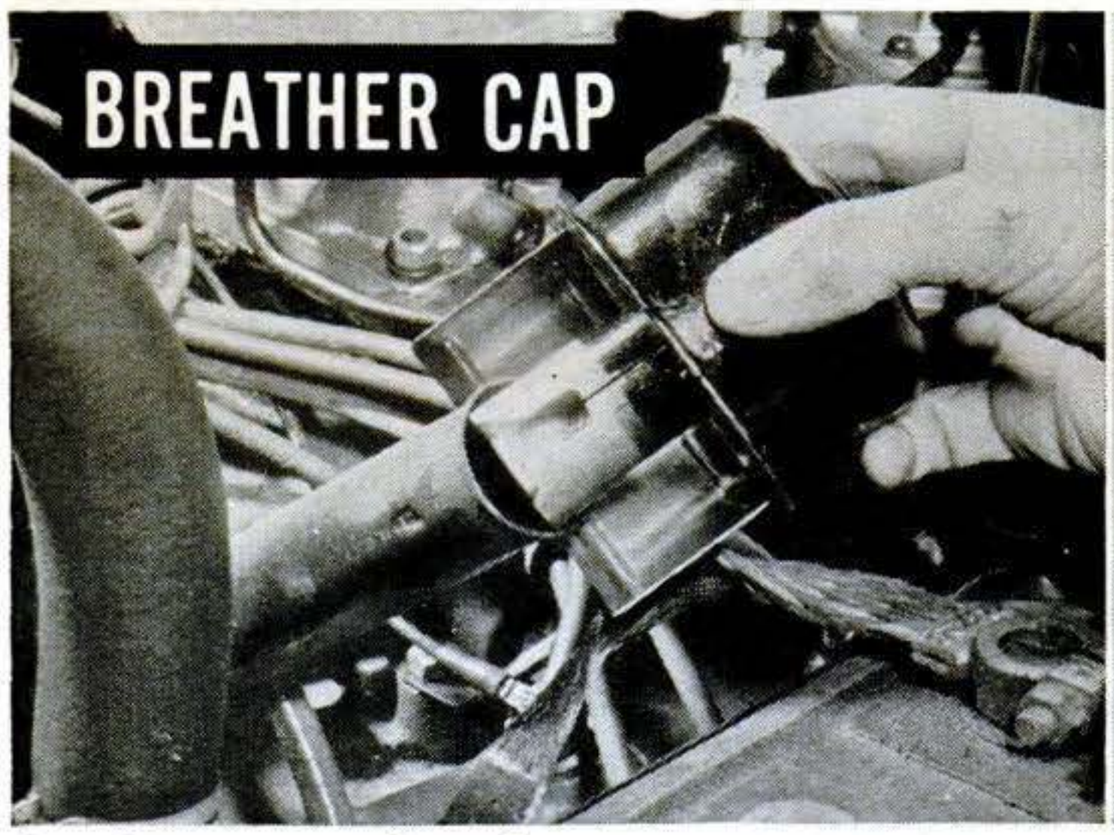
OIL FILTER

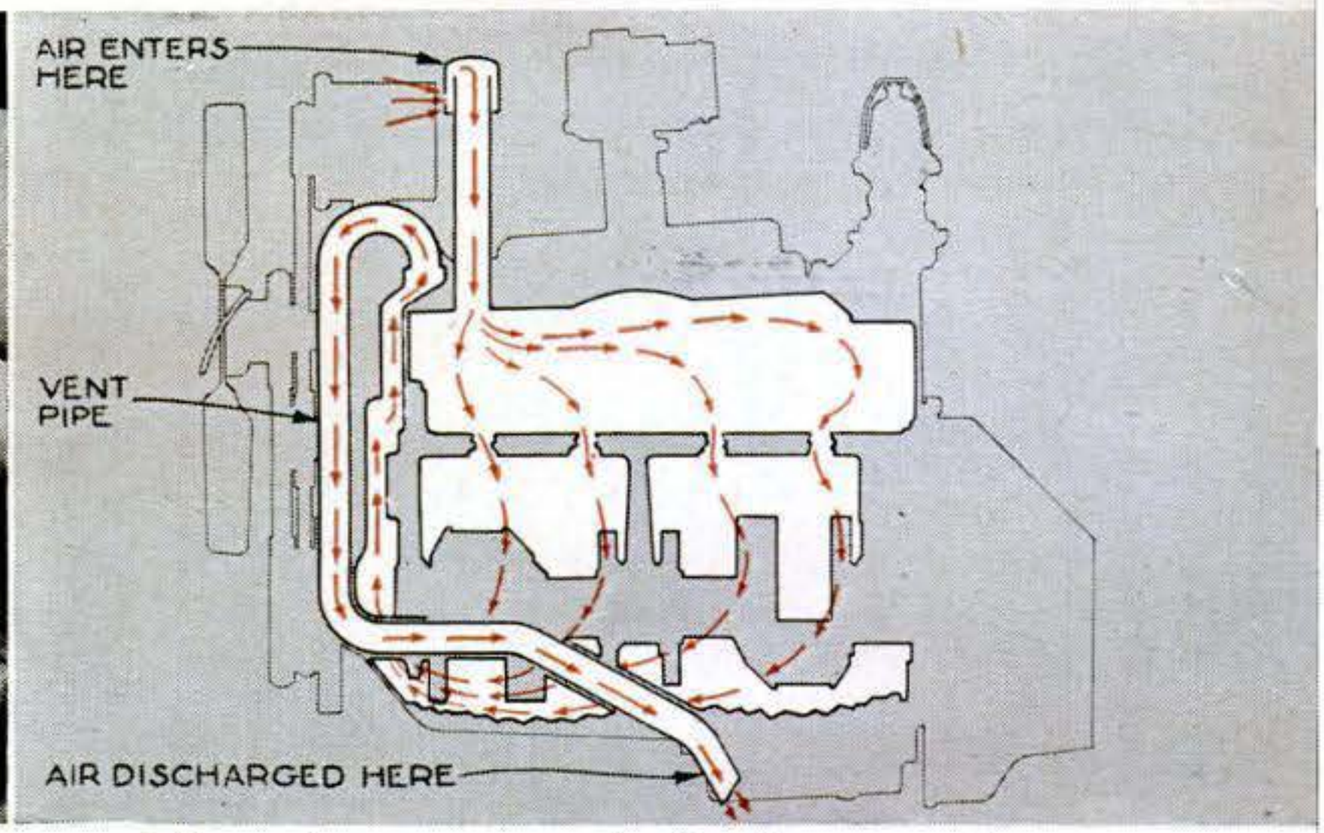
The most common oil filter, the by-pass type, is on a separate flow circuit of its own and delivers the filtered oil back to the crankcase where it mixes with unfiltered oil returned from the engine. Thus the mixture that is fed to the engine is only partly cleaned. A filter of the full-flow type is on the regular flow circuit, so it normally cleans all the oil just before it reaches the engine. Clean both types the same way.



How full-flow oil filter works is shown above. As engine starts, regulator valve momentarily by-passes some oil to engine (1). After filter fills up, valve sends all the oil through the filter (2). If excess pressure builds up during high speeds, valve sends part of oil back to crankcase (3). If cartridge clogs, a shunt valve opens, sending the oil direct to engine.

BREATHER CAP

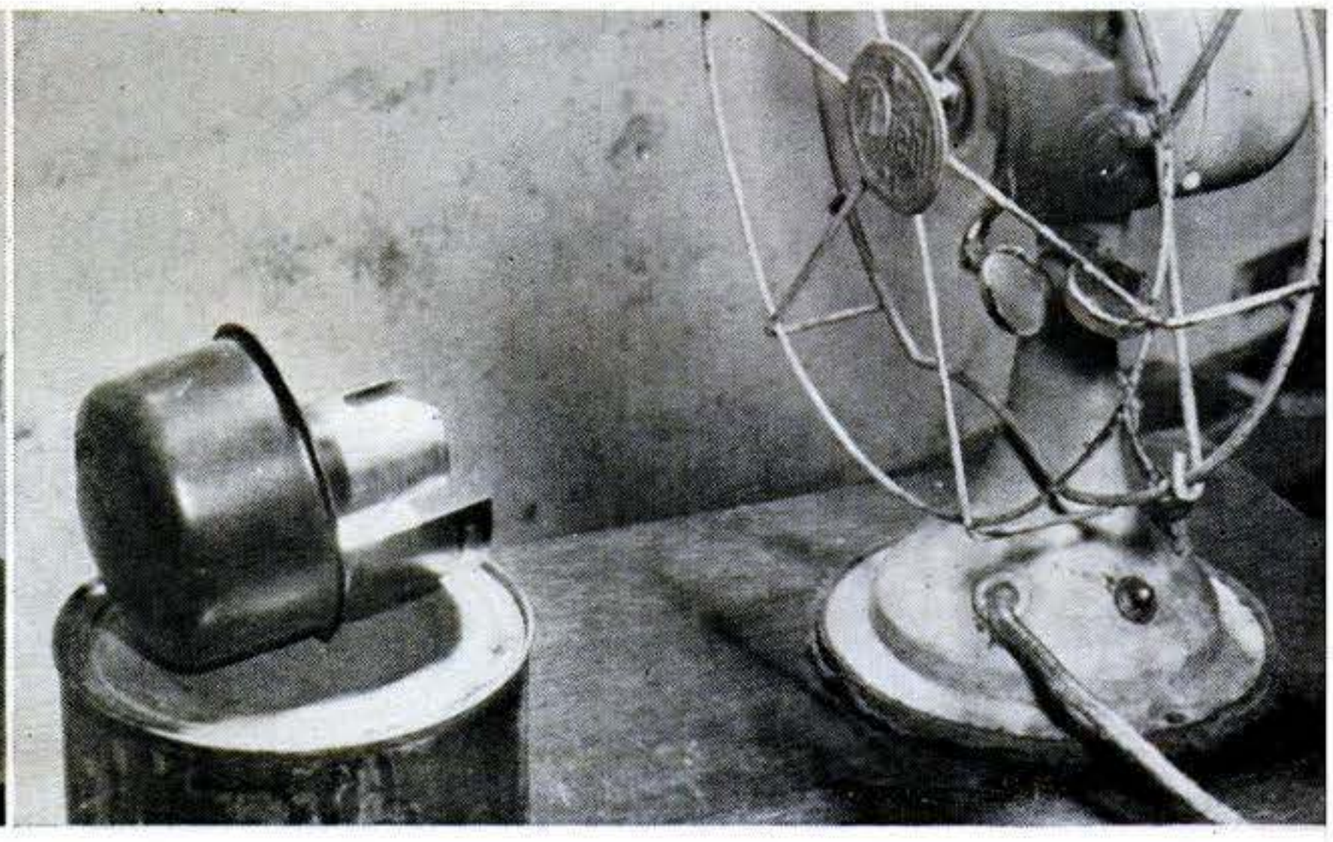




Air drawn into breather cap carries injurious vapors out of the crankcase through vent pipe under the car. In putting back the cap, be careful to place it correctly. In the type above, shield belongs at rear. Others have an air inlet that must face forward toward the fan.

Filter inside cap can be washed by immersing entire cap in a solvent. You can easily do this at home. Use kerosene or white gasoline.

Dry the cap well after washing. You can speed up drying with a fan this way. If you have an air hose, use it to blow out last bits of dirt.



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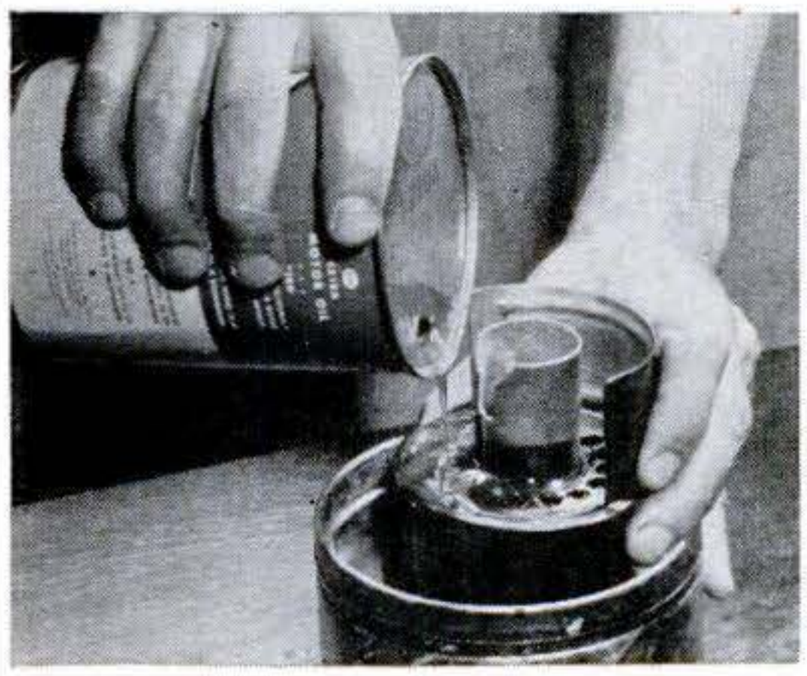
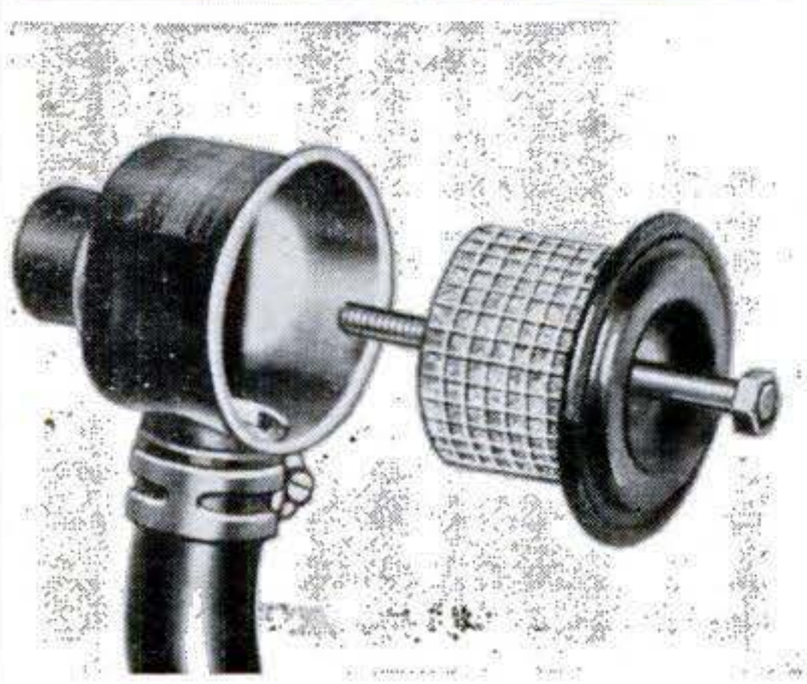
Oil-filter cartridge can be changed quickly during a gas stop, but it's best to have the oil changed at same time. Make sure container is drained and wiped dry inside as above.

Always use new cover gasket when putting new element in this type. The old gasket may leak oil. As a rule, make the change about every 5,000 miles—or when dipstick shows dirty oil.

Burning will clean a neglected cap if solvent won't. Pour a little gasoline into cap and set it afire in the open. Let it burn until flame dies out. Shake out residue.

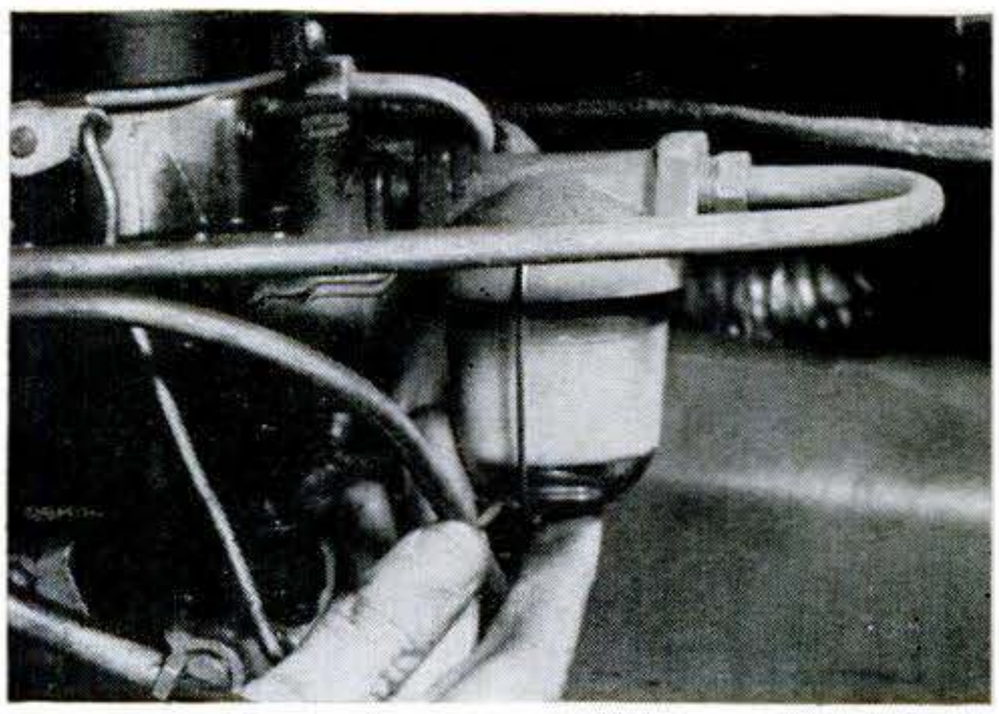


Re-oil cap after it has been cleaned. Pour the oil into it as at left or dip entire cap into container of oil. Use fairly heavy oil. Let the cap drain well before putting it on car.

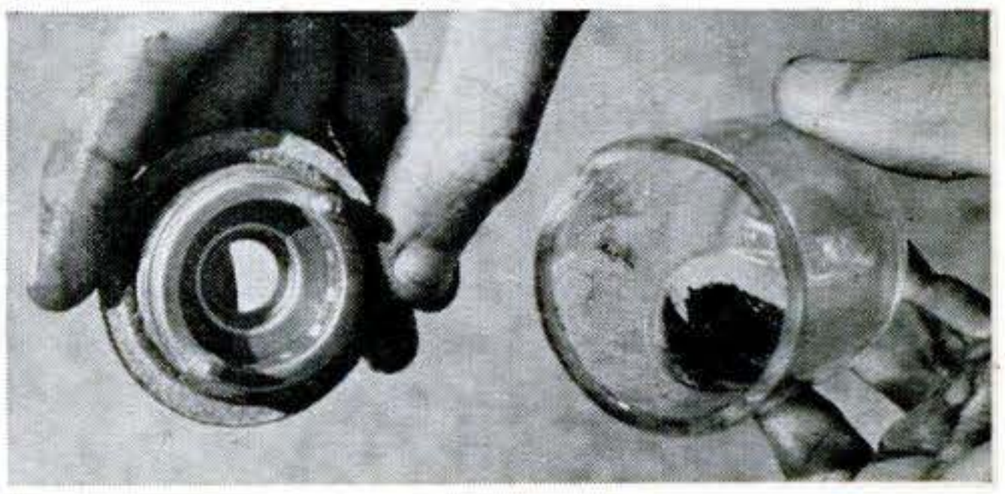


A vent-pipe filter is used on some cars. It traps the dust when an engine creates a chimney effect as it cools, drawing air up the vent pipe. Wash and re-oil like inlet filter.

FUEL FILTER



In a gasoline supply line there may be as many as three strainers. There's always one in the fuel pump. There may also be another adjoining the carburetor (above) and a third inside the carburetor inlet. Latter seldom requires attention, but the other two should be cleaned twice a year.



Dirt collects in a filter bowl this way. Empty the bowl and wash it and strainer in solvent. Blow through the strainer gently with an air hose. In putting bowl back, it's a good idea to use a new gasket.

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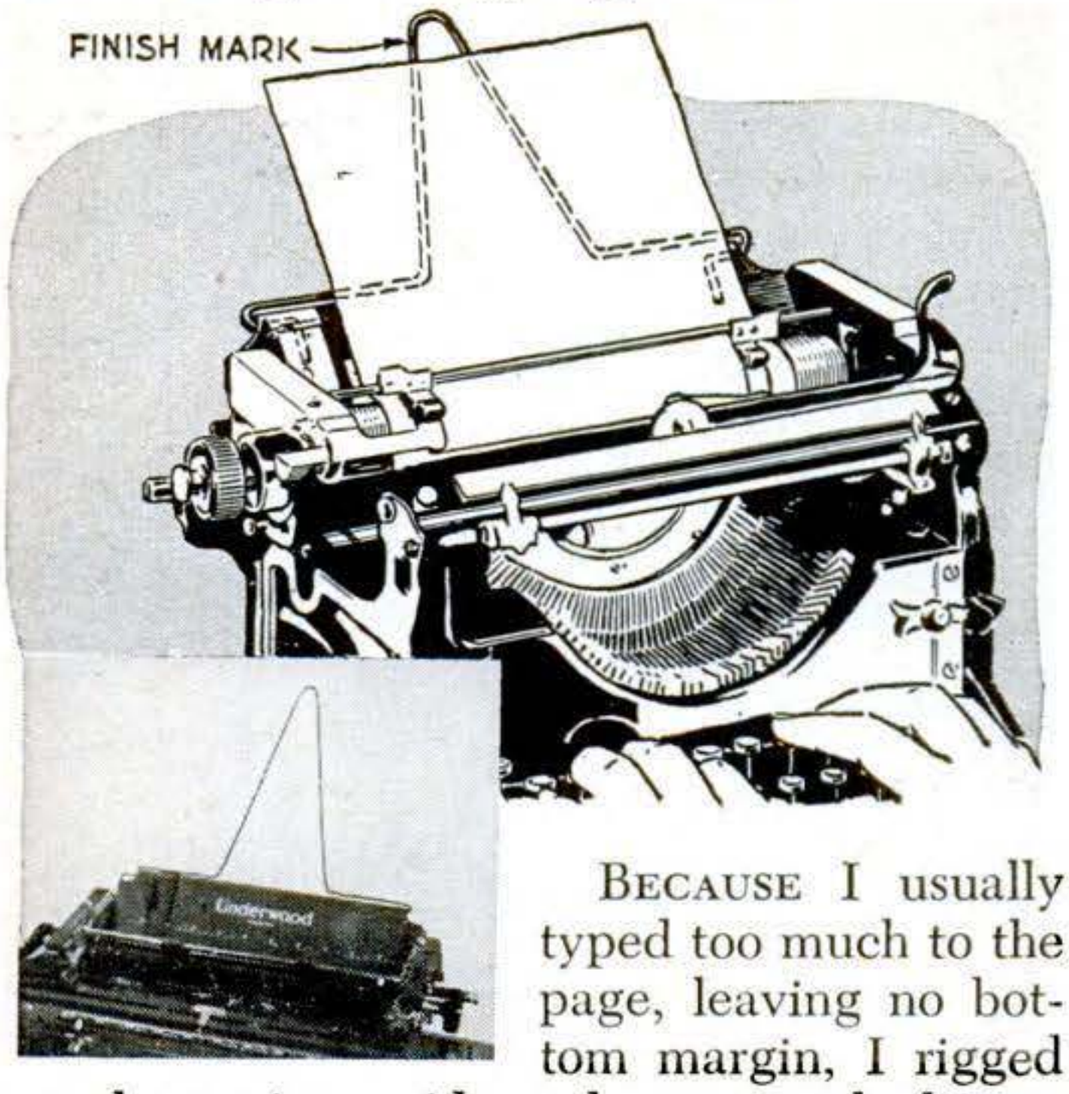
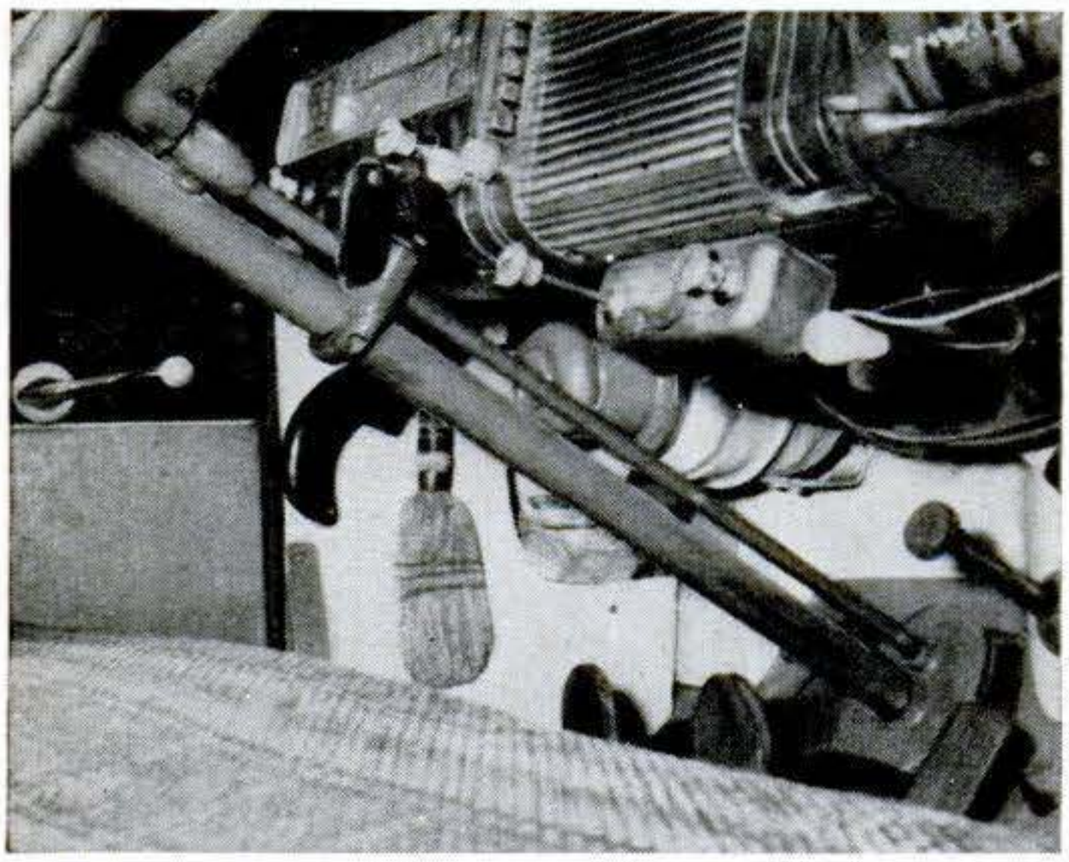
Coat Hanger Is Typing Guide



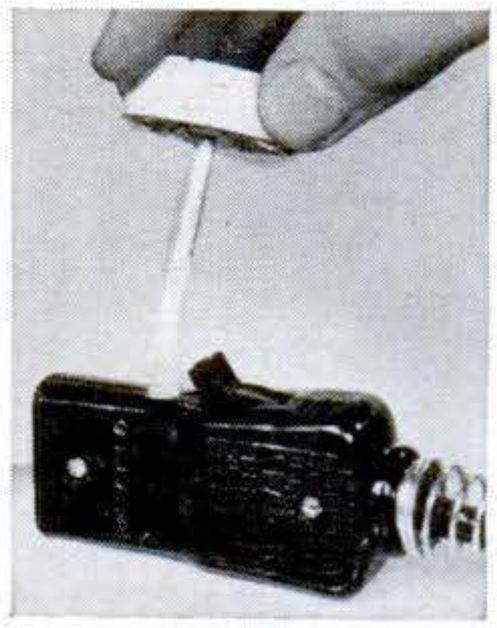
BECAUSE I usually typed too much to the page, leaving no bottom margin, I rigged up the typing guide and paper rack shown. Formed from coat-hanger wire, it clamps to the back of my typewriter. When the paper rolling around the platen reaches two paint spots on the wire, I know I have reached the bottom margin. The height of the rack supports the paper, keeping the typed matter always in view. The method of attaching the rack may vary with different typewriters.—*Bob Gilmore, Boyes Hot Springs, Calif.*

Red Brake Gives Custom Look



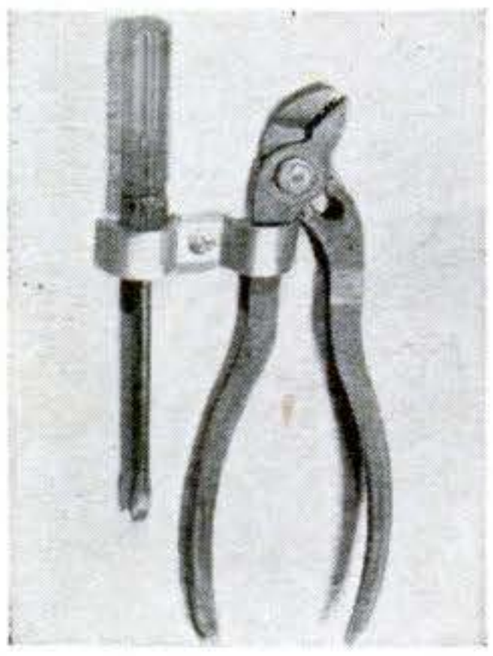
YOUR friends will ask if your car is a special model if you apply enamel where I did —fire-engine red on the emergency-brake handle, blue on the heater unit, and white on the fiber side panels under the cowl. The firewall also can be painted a light color if it is first sealed with shellac. A whisk broom suspended on a hook on the side panel, as in the photo, will help you keep the floor mats free of dirt and sand.—*Chauncey E. Nelson, St. Paul, Minn.*

Paint Marks Switch Position



MANY electric-iron cords have plugs with built-in switches, but they're rarely marked so that you can tell at a glance if the current is on or off. A drop of white touch-up enamel will indicate the "on" position and can be seen from some distance.—*H. Leeper, Canton, Ohio.*

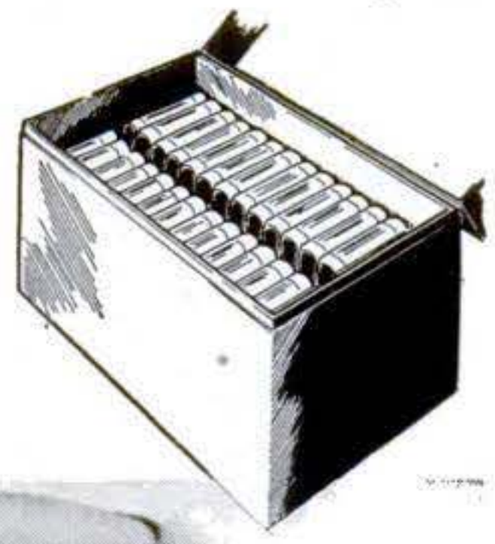
Cable Clamps Make Tool Holders

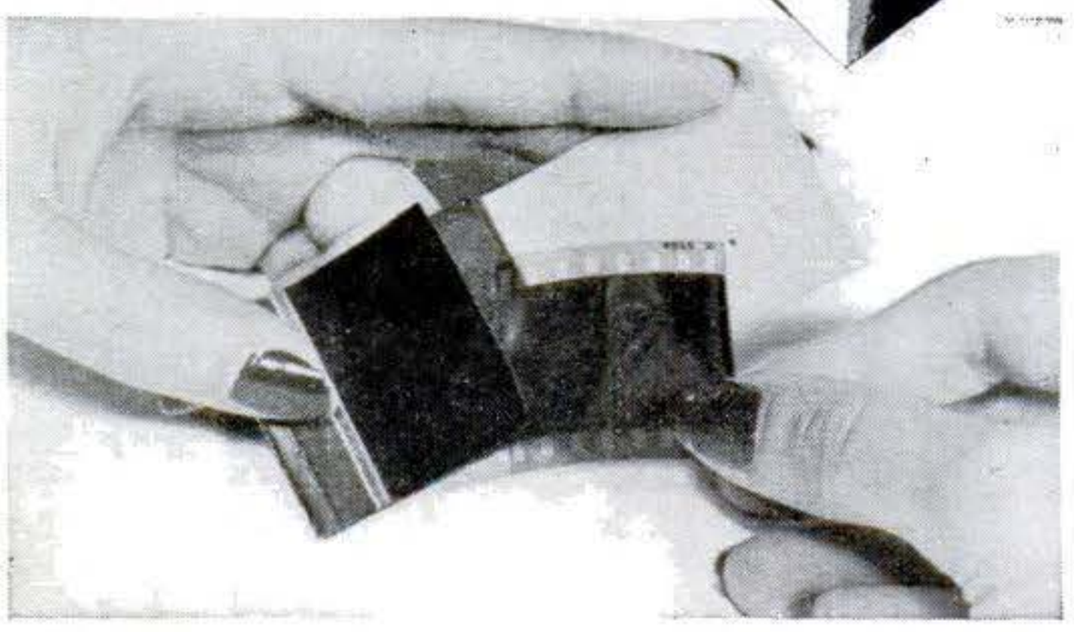


CLAMPS for BX cable make fine holders for small tools or kitchen utensils. If two clamps are overlapped and mounted with one screw, as shown at left, more tools can be fitted into the allotted space.—*John J. Rea, Urbana, Ill.*

Matchbooks Hold 35-Mm. Negatives

A MATCHBOOK cover, with a number of paper leaves inserted, makes a compact file for single 35-mm. negatives. After removing the matches from the folder, staple in a dozen or so 1½″ by 2″ sheets of black paper. File the negatives between the sheets and write any photographic memoranda on the paper with a white or yellow pencil. About thirty of these folders will fit in a 3″ by 5″ card file. Put a block of wood in the bottom of the box to raise the folders near the top and label each folder across the top to identify it.—*John J. Rea, Urbana, Ill.*





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Wipe-Clean Edges for Plastic Tops

YOU can top off that furniture you've built with the same gleaming, impervious surface you see on restaurant tables. Nothing beats it for kitchen cabinets, tables, playroom bars, and children's furniture.

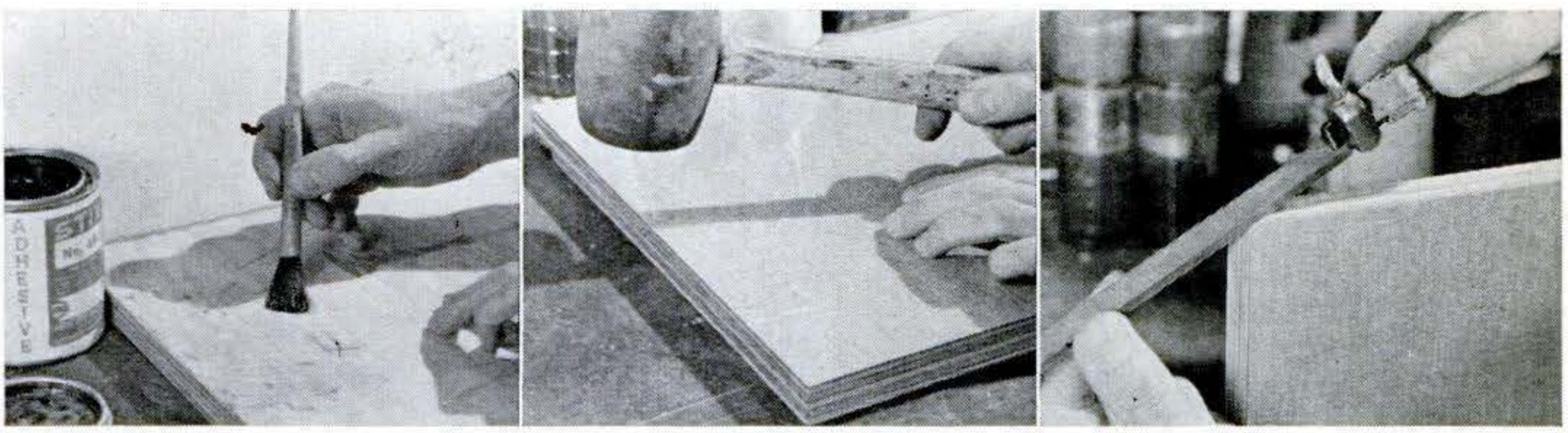
The material is sold under various trade names like Polatex, Formica, and Micarta. It can be bought already bonded to ¾″ plywood, but with modern cements you can fasten 1/16″ sheet to any wooden surface.

Instead of lipped molding, the photos show a neat edging of 1/32″ aluminum strip fitted flush with the plastic surface. This leaves no dirt-catching crack or overhang, and being thin, the strip doesn't require laborious mitering at corners. It's also easy to apply to rounded corners.

Fir plywood ¾″ thick makes a good core. Edges should be cut square and the top surface sanded smooth. Make a trial fitting on the furniture before applying the plastic sheet cut 1/16″ oversize all around.

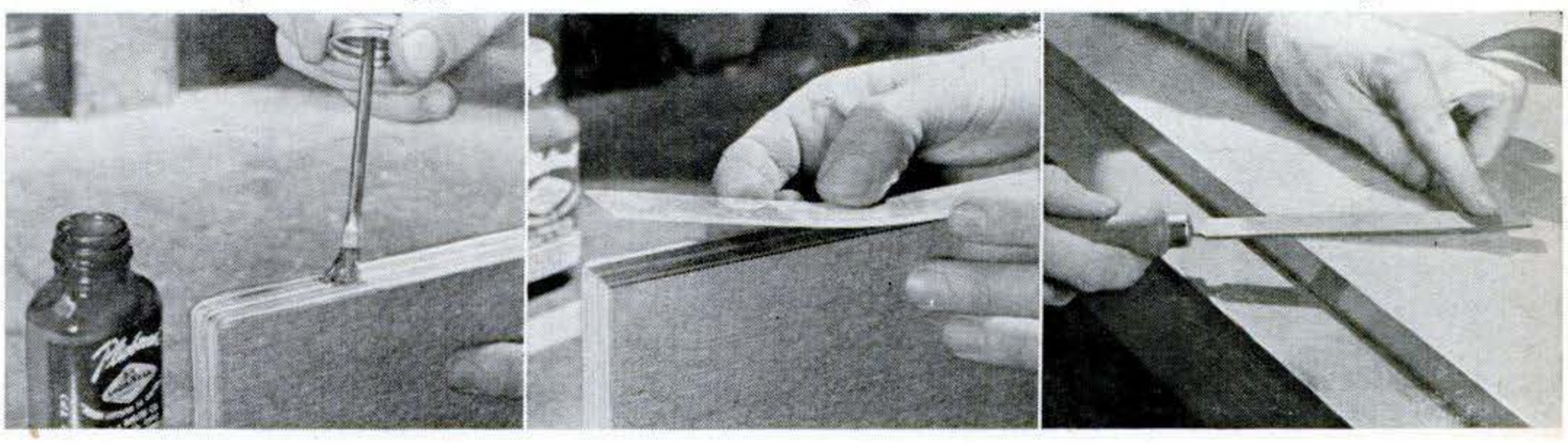
An adhesive that doesn't require clamping is most convenient. You can also use a casein or a resorcinol resin glue, but these call for clamps or weighting. An adhesive designed to hold metal on wood should be used to hold on the aluminum edging, which can be further secured with escutcheon pins or countersunk screws.

Trim the strip flush with both surfaces of the panel, being careful not to mar the plastic top. Where the strip projects a lot, it can be cut down fast with a sharp plane. Rub the aluminum to a satin finish with steel wool.—*W. E. Burton, Akron, Ohio.*



Apply cement both to well-sanded wood top and underside of plastic sheet. Let it dry briefly. Then lower sheet carefully in precise alignment with panel (once surfaces touch, they can't be shifted). Hammering with rubber mallet improves bond with cement shown. After adhesive has set, dress edges of plastic flush with wood. Use a file or run the edges over a jointer.

Cut aluminum strip slightly wider than panel thickness. Cement shown is brushed on both the surfaces, let dry 30 minutes. Then one surface is "activated" (made tacky) with a second thin coat. Apply strip and hold with clamps or cord binding overnight. Then dress it flush with panel surfaces, holding flat file at a slight angle so that it doesn't touch the plastic.



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The Tools That Save Homes

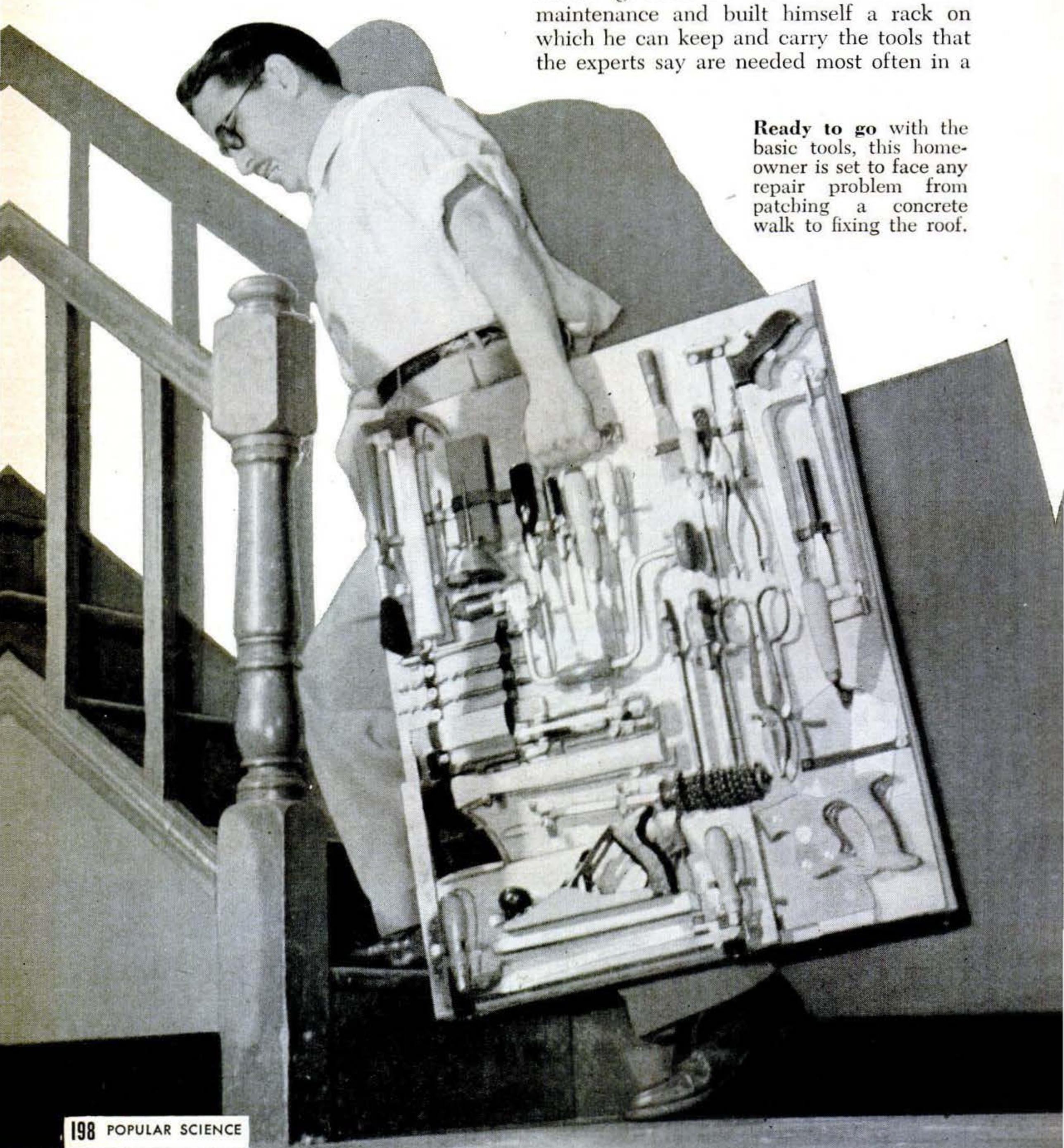
Having this government-recommended arsenal always ready will help you ward off costly repair bills.

By George H. Waltz, Jr.

PS STAFF PHOTOS

DEFENDING a home against the ravages of time is easy if you have the right tools in the right place at the right time.

The young homeowner pictured below is well armed for 1951 because he has consulted government handbooks on home maintenance and built himself a rack on which he can keep and carry the tools that the experts say are needed most often in a



Ready to go with the basic tools, this homeowner is set to face any repair problem from patching a concrete walk to fixing the roof.

typical American home. On the following two pages you'll see these 36 basic tools.

The portable tool rack has all the advantages of an over-the-bench type and none of the disadvantages of the usually cluttered toolbox.

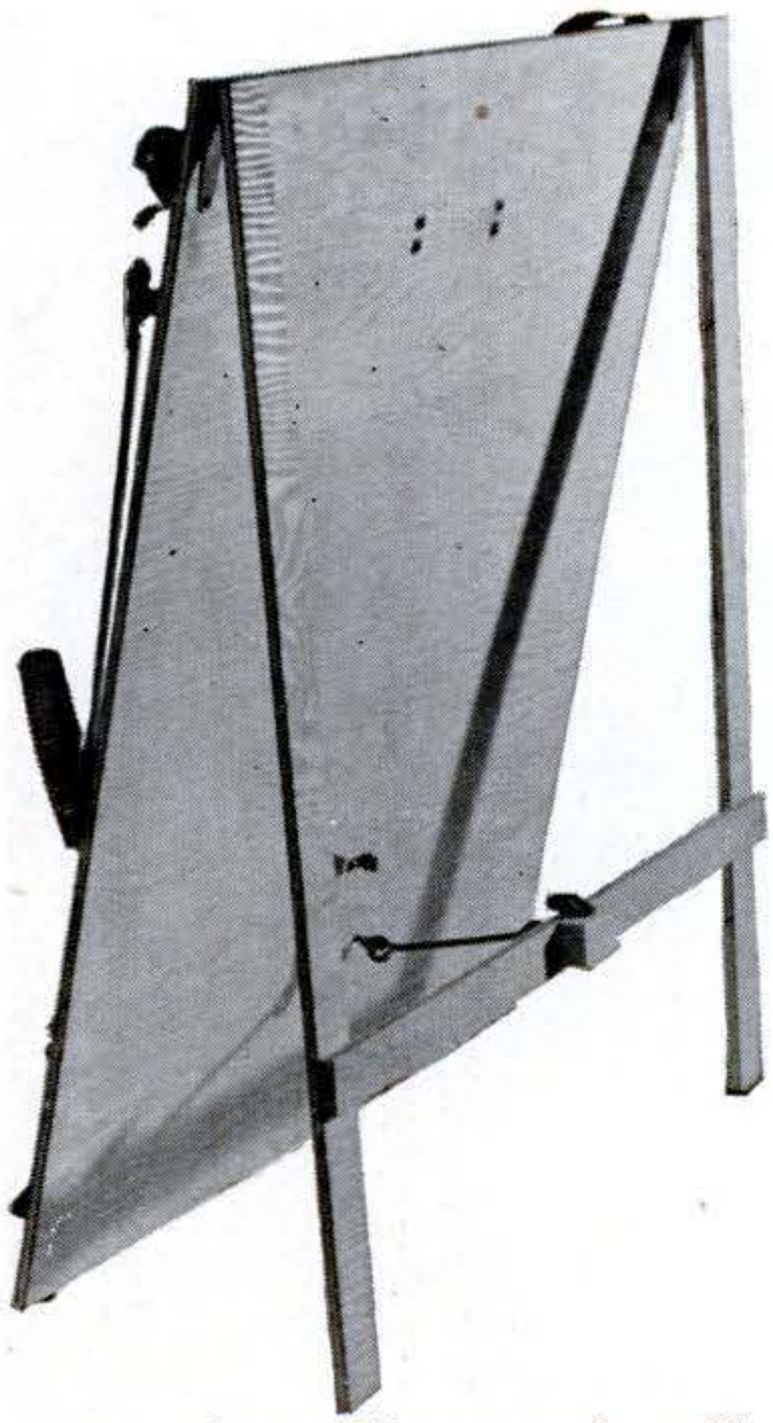
Each tool is always in plain view and each tool can easily be lifted off and put back. If a tool is missing, its outlined empty spot tells you so. Besides, since the rack can be carried to any part of the house, all your tools will be right at your elbow no matter where you are working.

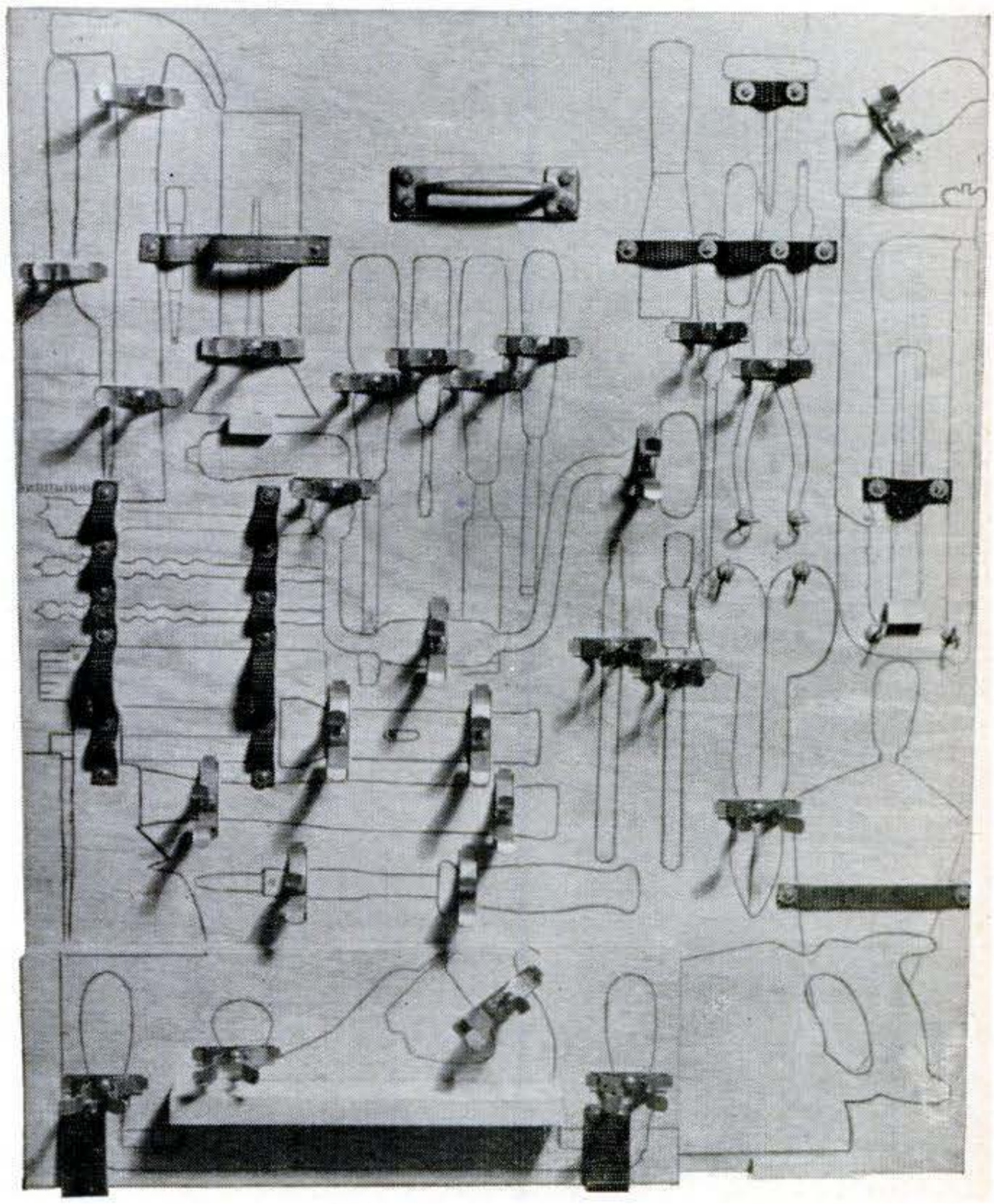
The rack completely eliminates those needless trips to the cellar for a screwdriver or a hacksaw that you didn't think you'd need. Finally, the rack is easier and cheaper to build than the simplest kind of tool chest or cabinet.

Basically, the rack is nothing but a rectangle of plywood fitted with easel-type legs that can be folded flat and fastened when the rack is being carried. When not in use, the rack can be stowed in a closet.

The fasteners used to hold the tools in place are such easy-to-get things as spring clips and strips of leather and rubber. The complete rack, including lumber, shouldn't cost you more than $5. And it can be built with the simplest tools.

Here's the Rack and How to Build It





Follow this tool layout and you'll be able to fit neatly 36 tools on your portable rack. Rear view shows legs locked open by hook and catch used to hold legs closed.

THE tool board is plywood—⅜″ by 26″ by 32½″. The plywood legs are ⅜″ by 1½″ by 32½″. They are attached at the top corners of the board by 3″ strap hinges. A 6″ hook fits a screw eye on the spacer between the legs to lock the legs in an open position. When the legs are folded for carrying, a snap catch holds them flat against the back of the board.

The saw compartment is a piece of ⅜″ by 6¾″ by 17¾″ plywood mounted on ½″ by ½″ spacers at top, bottom, and left end. A ½″ by ½″ by 2¾″ block supports the handle end of the saw. The plane rests on a ¾″ by 1½″ by 10½″ block of wood.

To protect the rack, brush on a coat of clear lacquer after the outlines of the tools have been painted on the board.

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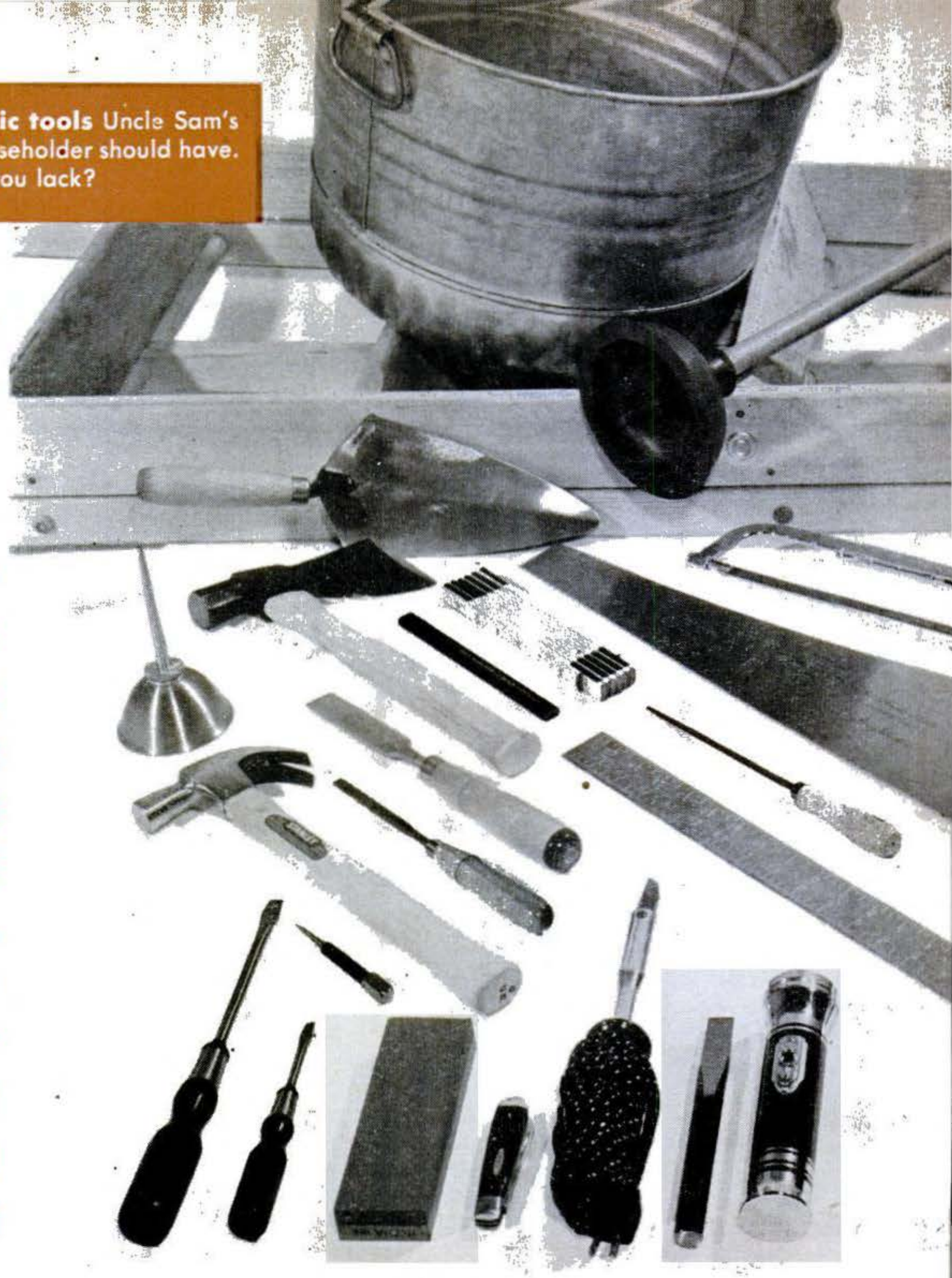
Here are the 36 basic tools Uncle Sam's experts feel that the householder should have. How many of them do you lack?

CLAW HAMMER
HATCHET
NAIL SET
CHISEL (1/4")
CHISEL (7/8")
COLD CHISEL
SMALL SCREWDRIVER
LARGE SCREWDRIVER
JACKKNIFE
DRAWKNIFE
PUTTY KNIFE
MASON'S TROWEL
HANDSAW (CROSSCUT)
HACKSAW
GIMLET
MONKEY WRENCH
STILLSON WRENCH



Keep Your Tools Fit

JUST as important as having the right tool for the job is having it in good shape to do the job right. Here are a few tips that will help you to keep your tools in top working condition:

Screwdrivers. Don't use them as pries or jimmies. Always match the screwdriver to the screw slot; don't try to drive a large screw with a small screwdriver.

Jackknife, chisels, drawknife, and smoothing plane. Keep them sharp. There is nothing more discouraging than trying to use dull cutting tools. Protect their cutting edges. When a plane is not in use it should be stored so blade won't be injured. Avoid nails. Warn your family, particularly the feminine members, not to use your chisels as screwdrivers.

Wrenches. Don't use them as hammers. Oil them occasionally to prevent rust. Adjust jaws snugly against work to prevent scoring jaws and work.

Putty knife and trowel. Keep them clean and free of rust. Don't let cement, putty, etc., harden on them.

Hand saw. Keep it sharp and oiled to

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SMOOTHING PLANE
THREE-CORNERED FILE
SOLDERING IRON
WIRE-CUTTING PLIERS
BRACE AND BITS
GLASS CUTTER
METAL SHEARS
FRAMING SQUARE
FOLDING RULE
PAINT BRUSH
GALVANIZED BUCKET
SMALL WASH TUB
FORCE CUP
STEPLADDER (6')
OIL CAN
OILSTONE
FLASHLIGHT
CARPENTER'S PENCIL
FUNNEL

prevent rust. Avoid nails. Buy a good saw and keep it in good condition. It will save you time and effort.

Soldering iron. Keep it clean and the tip always tinned ready for use.

Paint brush. Always clean it immediately after use and store it wrapped in folded paper to maintain its shape.

Brace and bits. Keep the bits sharp and both brace and bits free of rust. Avoid nails.

Pliers. Keep the cutting edges sharp. Prevent rust. Don't use as a hammer.

Steel square. Oil occasionally to prevent rust. Keep it out of contact with other tools to preserve its scale markings and straightedges.

Nail set. Don't attempt to use it as a punch.

Oilstone. Clean its honing surfaces occasionally with a brush dipped in kerosene. Avoid any contact with tools that might chip or mar the honing surfaces.

Stepladder. When it is new, sand off any rough edges or splinters; then wax it. A coat of wax will make it easier to remove paint splatters and other stains.

Force cup (plumber's friend). Wash the cup thoroughly after use. Grease, if left on, may damage the rubber. END

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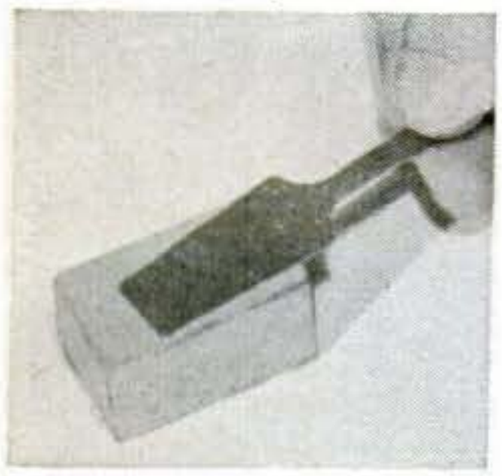
Extra Felting Improves Sander

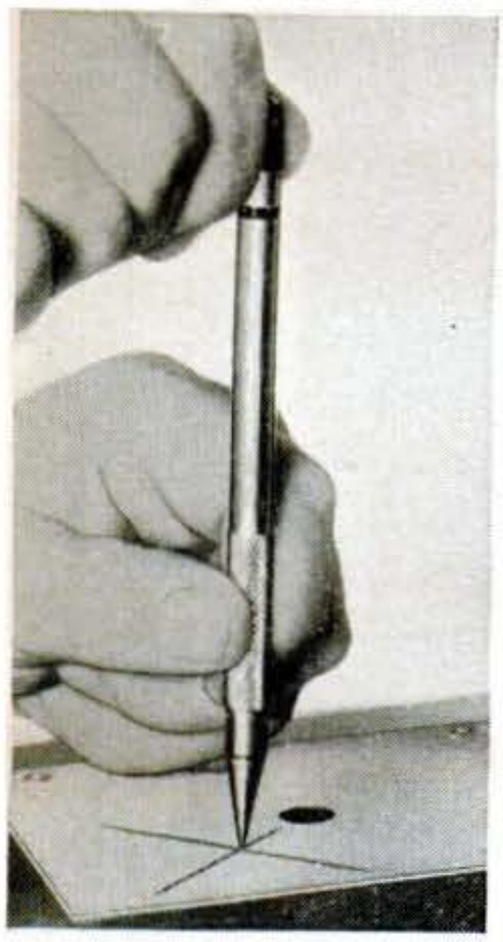
METAL flanges on the platens of inexpensive electric sanders can gouge and mar the work if the tool is tipped up. An extra thickness of felt over the platen pad provides increased clearance to help prevent this. Glue on the felt as shown. Material from a discarded fur-felt hat is good, for it's thicker than ordinary felt, and costs nothing. *—Walter J. Waldon, Freehold, N. J.*

Cheese Spreader Applies Glue



YOU may find a plastic cheese spreader superior to a brush for applying a thin, even coat of household cement or glue. Be sure to wipe the blade clean after use.

Centerpunch Has Its Own Hammer



THE depth of indentation made by this spring-powered centerpunch is controlled by the height the head is lifted and the number of times it is released. The higher the head is pulled up, the harder the spring inside drives the punch point into the work. It's priced at $1.50 and manufactured by Lakelin Products Co., Dayton, Ohio.

Pivoted Brush Turns Corners

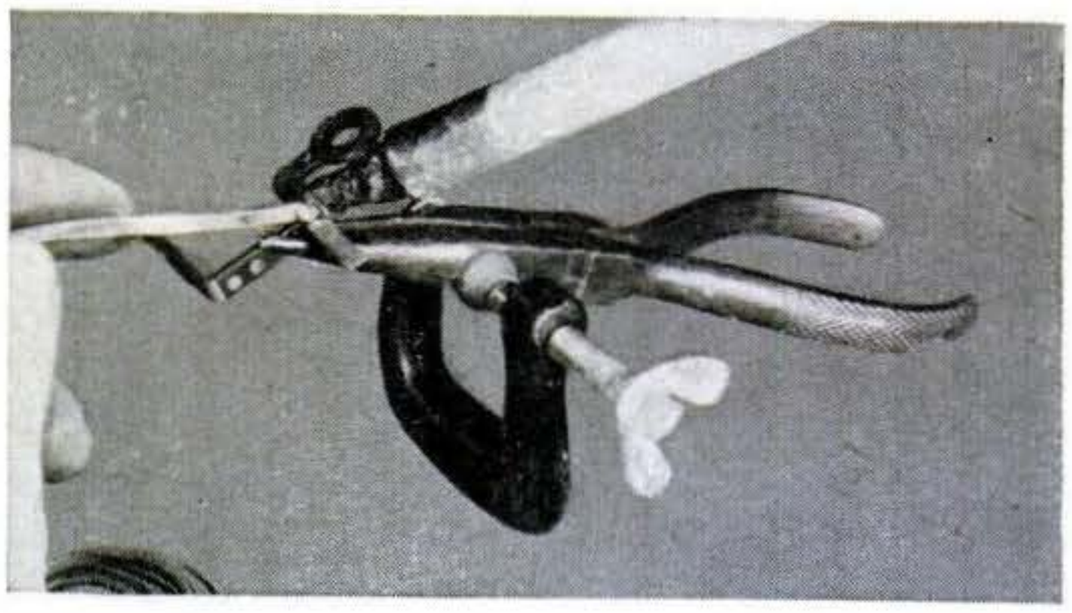
THE brush from a discarded typewriter eraser, pivoted in a handle as shown, is convenient for dusting photo equipment. I attached the brush to a plastic key holder, but a slotted-end dowel will serve as well. Remove the eraser and attach the brush to the handle as tightly as possible with a screw. Bent at an angle, the brush simplifies the problem of dusting the folds inside a camera bellows.*—John J. Rea, Urbana, Ill.*

Bag Protects Casting Reel on Rod

A CASTING rod can be kept ready for use at all times with the reel in place if you protect the line as shown below. Equip the open end of a small bag with draw strings, and cut and stitch a hole in the other end just big enough to slip over the butt of the rod. Pull the draw strings tight ahead of the reel. The rod can then be carried through brush that might snag the reel. *—E. V. Reyner, Townsend, Mont.*

Clamp and Pliers Form Tiny Vise

IF YOU don't have a suitable vise for holding jewelry or other small objects for soldering, try improvising one like this. Grasp the object to be soldered with narrow-nosed pliers and tighten the pliers in a small C clamp. Put the clamp just past the pivot.*—J. Van Siclen, Queens Village, N. Y.*



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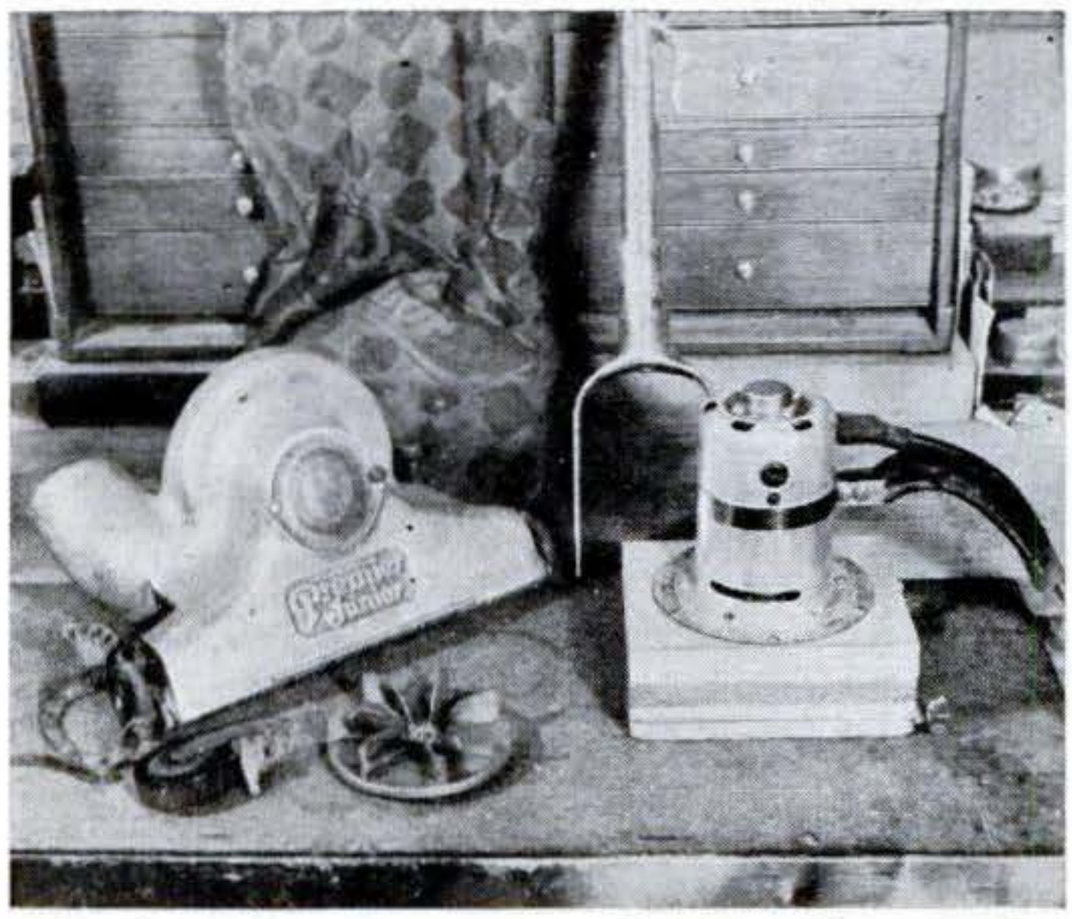
Homemade Power Sander



What's left of vacuum cleaner after sander has been built is shown at left. Only parts of vacuum you need are motor and belt pulley.

For a few dollars you can build it from an old vacuum-cleaner motor. Other parts will come from your scrap box.

By Herbert Pfister

PUTTING a professional finish on your woodworking projects is easy with this sander-polisher. It will leave most any wood surface satiny smooth, and then follow up by doing the tedious job of polishing. And all with little effort on your part.

The principal part of the machine is an old vacuum-cleaner motor. If you don't have one, you can pick one up secondhand for a few bucks. The light-duty type shown does fine.

Other than the motor, you'll need two

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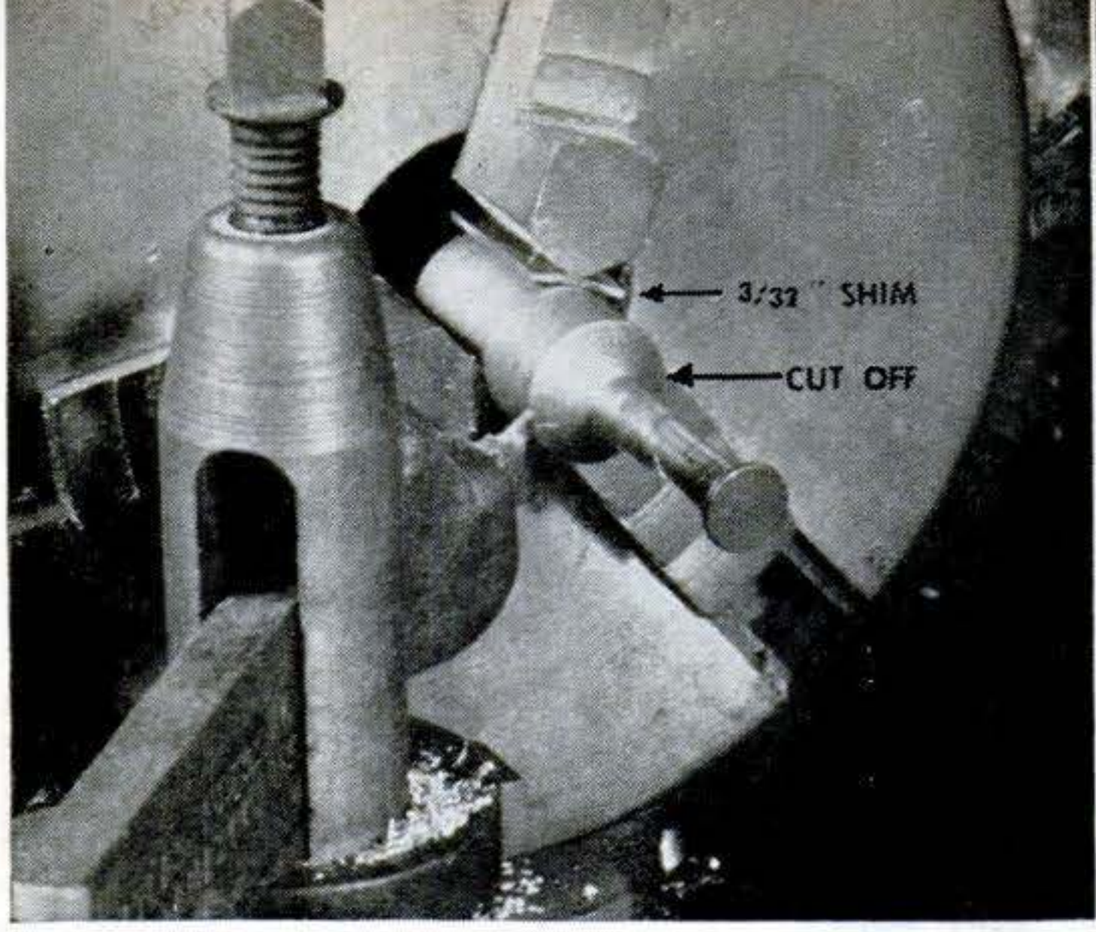
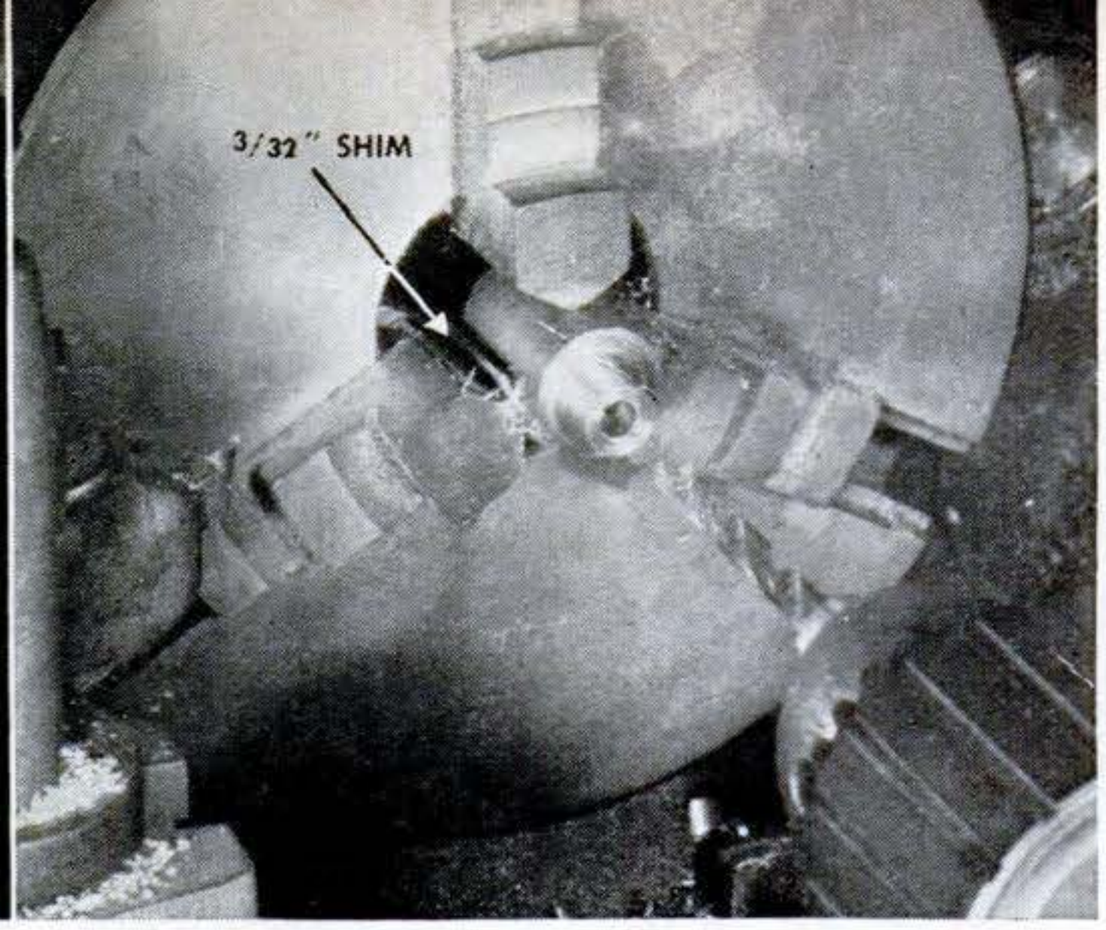
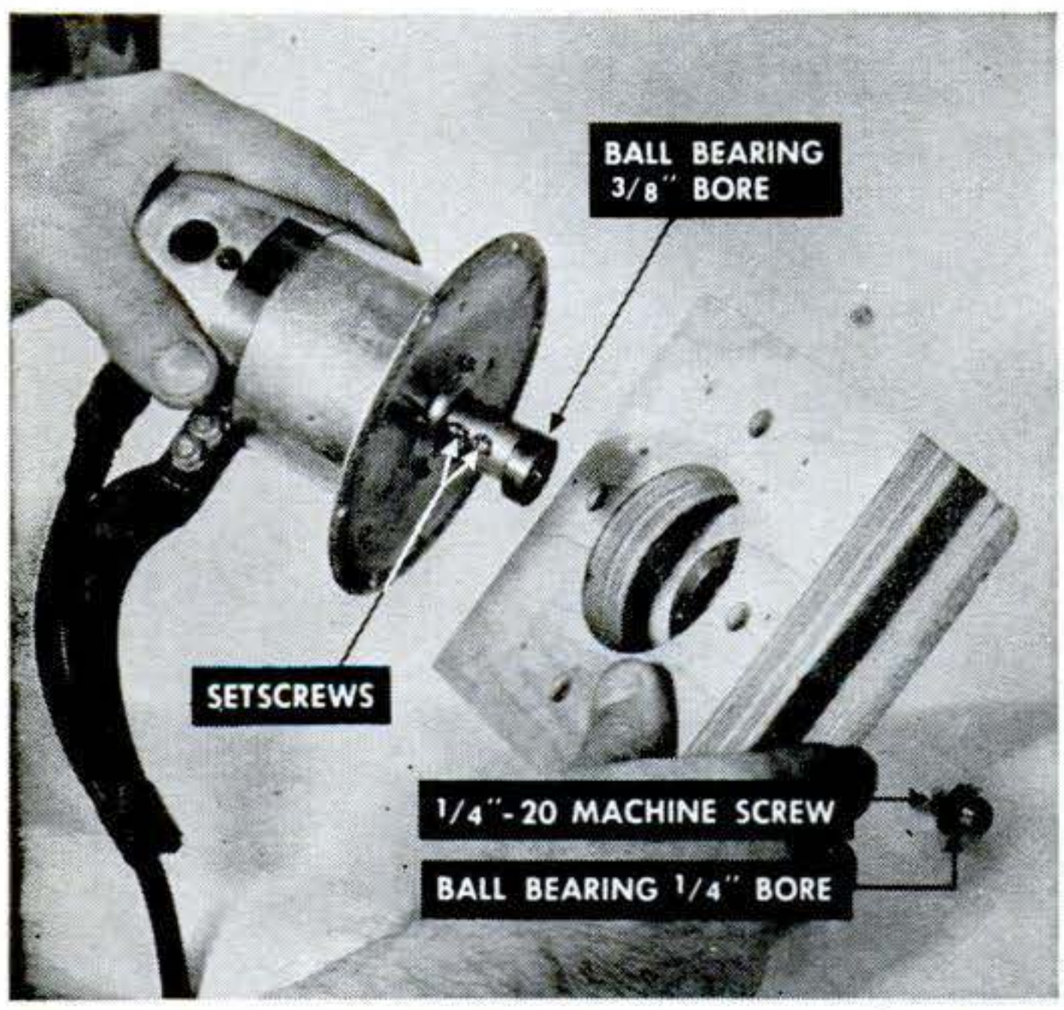


Pulley for the belt that drove the vacuum's brush is cut off, as shown above, before the remaining stub is turned off center.



Shim under one jaw holds piece off center. After turning, the eccentric end is drilled and tapped for the ¼"-20 retaining screw.



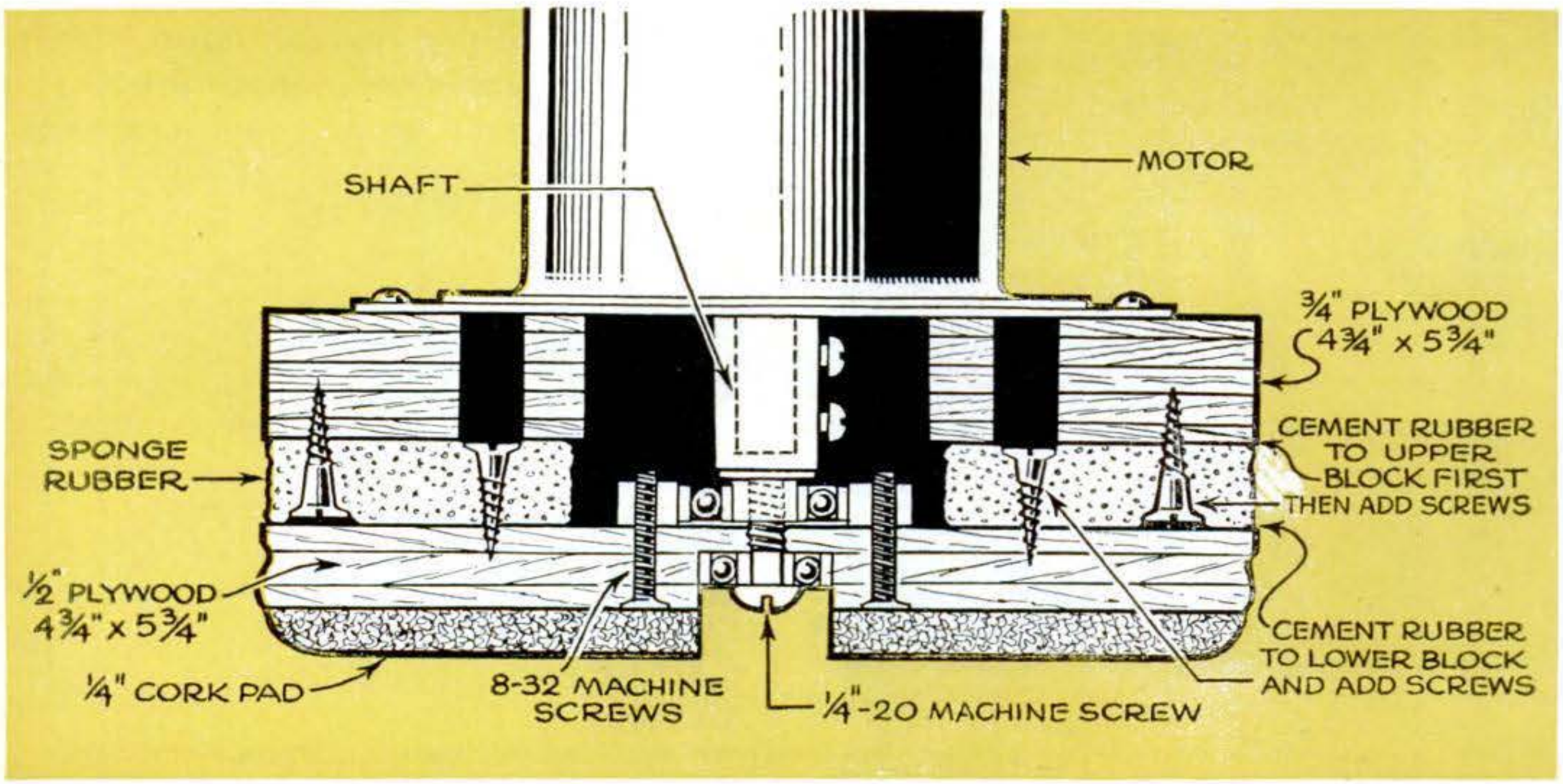
The ⅜" ball bearing on eccentric slips into steel disk fastened to movable block. Disk is just visible through hole in motor block.

ball bearings, sponge rubber, a few screws, and plywood from your scrap box. A foot rheostat for a sewing machine is handy for controlling the sander's speed.

The sander operates on an eccentric principle. One end of the motor belt pulley is turned off center. The eccentric end turns in a ball bearing set into the moving block. Thus when the shaft turns, the sanding block moves in a tight circular orbit.

Chuck the belt pulley in a lathe with a 3/32" shim under one chuck jaw. This throws the pulley off center so you can turn the end eccentric. Turn it down to fit snugly in a ⅜"-bore ball bearing. Also drill and tap the eccentric end ¼"-20.

The outside of this ball bearing fits within a ¼" steel disk that is bolted to the moving block. A recessed washer about 1¾" in diameter—the kind that goes on a shaft be-



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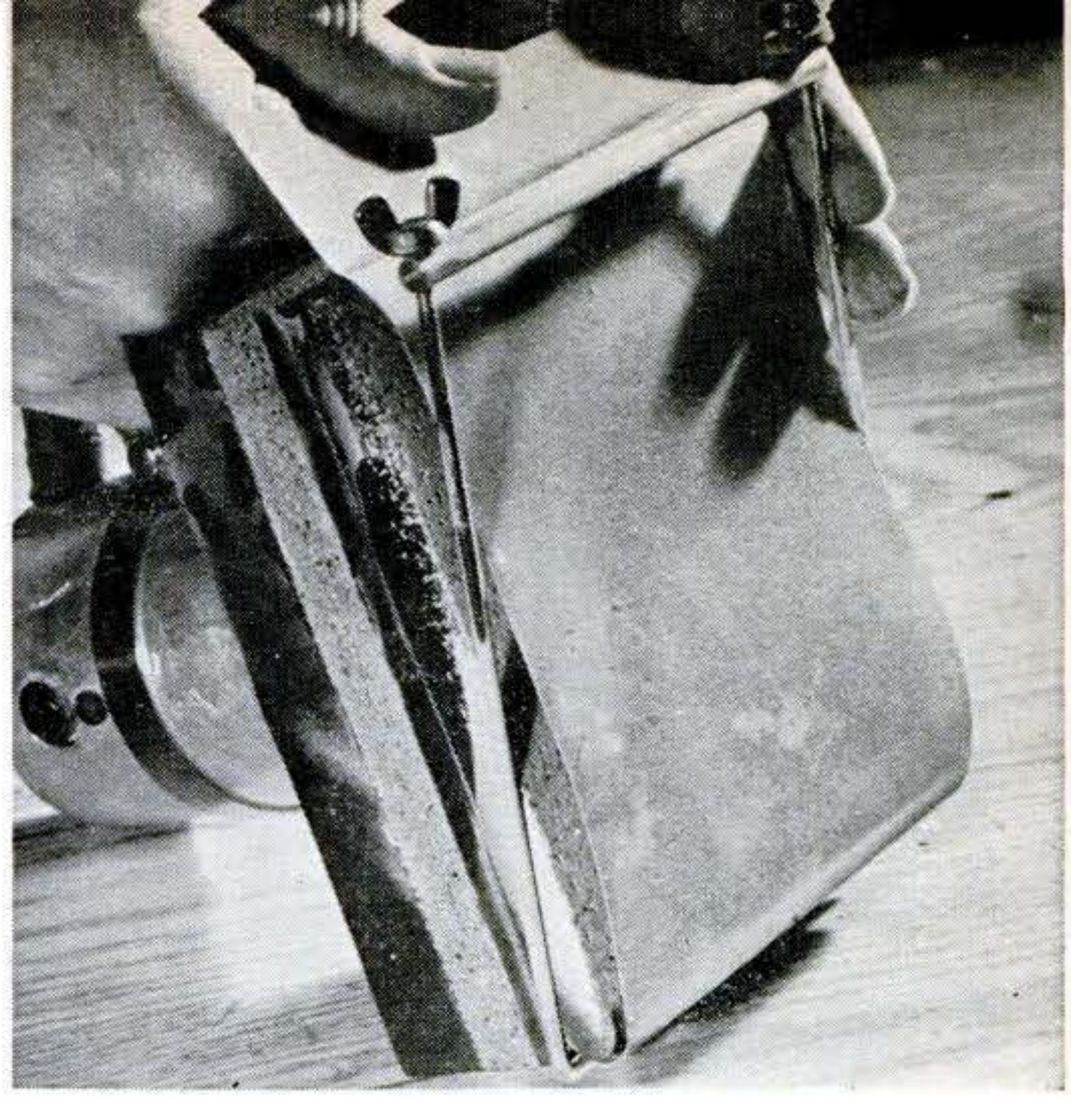
tween a grinding wheel and a nut—will do for the disk. Bore it out to a snug fit for the bearing. Also drill and tap the disk for the four 8-32 machine screws that hold it to the moving block.

Two pieces of plywood and a slab of sponge rubber make up the motor base and moving block, as shown in the drawing on the preceding page. A ¼″-20 machine screw through the bottom and into the tapped hole in the eccentric locks the whole assembly together. Cut the ¼″-20 screw so that it turns tight or bottoms before pulling up on the inner race of the ¼″-bore ball bearing.

A handle from a glass coffee maker can easily be adapted to the sander. Just shorten the steel band to fit tightly around the motor. The ⅛″ steel rod around the lower block holds sandpaper in place. END



U-shaped paper clamp was bent from ⅛″ steel rod and threaded 5-40 on ends for wing nuts. Steel rod across U holds one end of paper.

Hose Clamp Repairs Tool Handles

NEED a new ferrule for repairing that favorite garden tool? A hose clamp makes a good one and can be made tight even on a splintered or otherwise damaged handle. Since it opens, you needn't even pull the tool shank out of the handle to put the clamp on.—*Robert Hoppough, Encino, Calif.*

Marking Device "Brands" Your Tools

WITH the Moto-Write, a vibrating marking device that looks like a chubby pencil, you can "brand" all your tools from screwdrivers to lawn mowers. It uses 115-volt AC, and by changing the bit you can etch glass or tool leather. Montgomery and Co., New York City, sells it for $6.00.

HARD AND SOFTWOOD

A softwood does not necessarily come from a tree whose wood is soft, nor is a hardwood always one that is hard. Some softwoods are harder than many hardwoods and a few of the hardwoods are among our softest woods. No definite degree of hardness divides the two groups.

The distinction is this: In the lumber trade, there has developed a custom of calling the coniferous trees softwoods and the broad-leaved trees hardwoods. Coniferous trees, popularly called evergreens, are those with needles or scale-like leaves. Broad-leaved trees are often termed deciduous because most of those in the United States shed their leaves each year.

According to the National Lumber Manufacturers Association, softwoods found in the United States include the cedar, juniper, cypress, Douglas fir, true fir, hemlock, larch, pine, redwood, spruce, tamarack, and yew.

Hardwoods include the alder, ash, aspen, basswood, beech, birch, buckeye, butternut, cherry, chestnut, cottonwood, elm, gum, hackberry, hickory, locust, magnolia, maple, oak, sycamore, walnut, willow, and yellow poplar.

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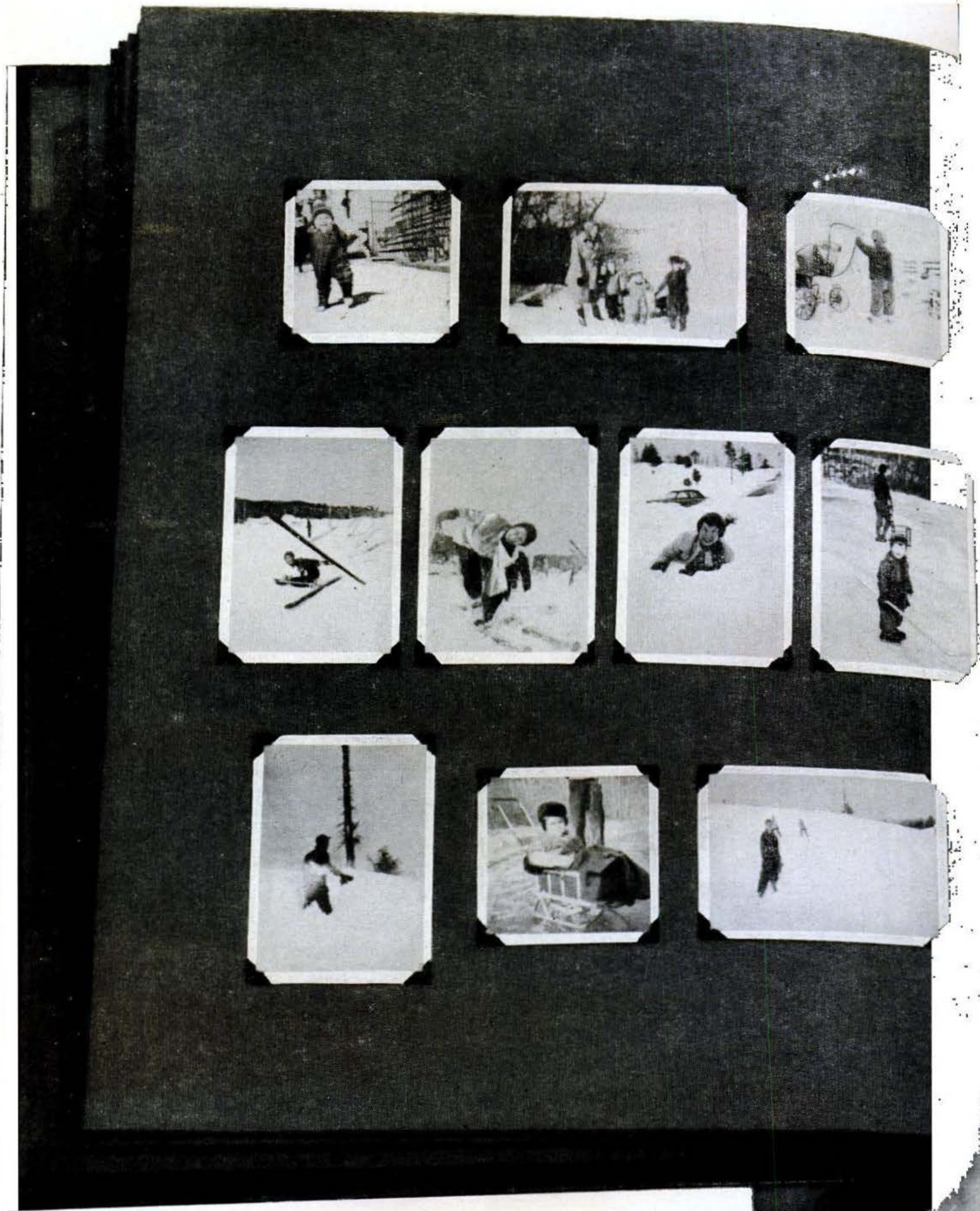
Does Your Album Look Like This...



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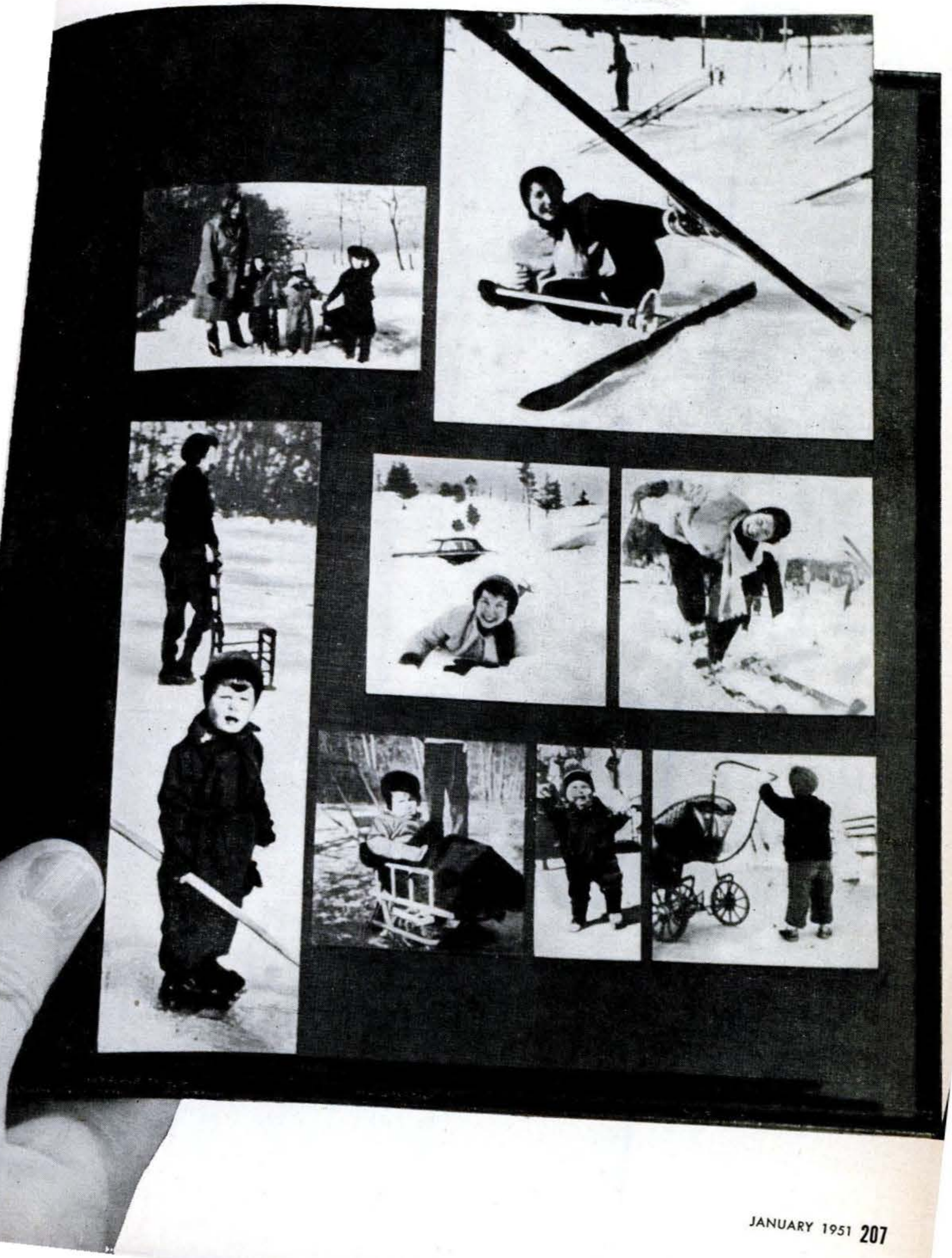
...or This?

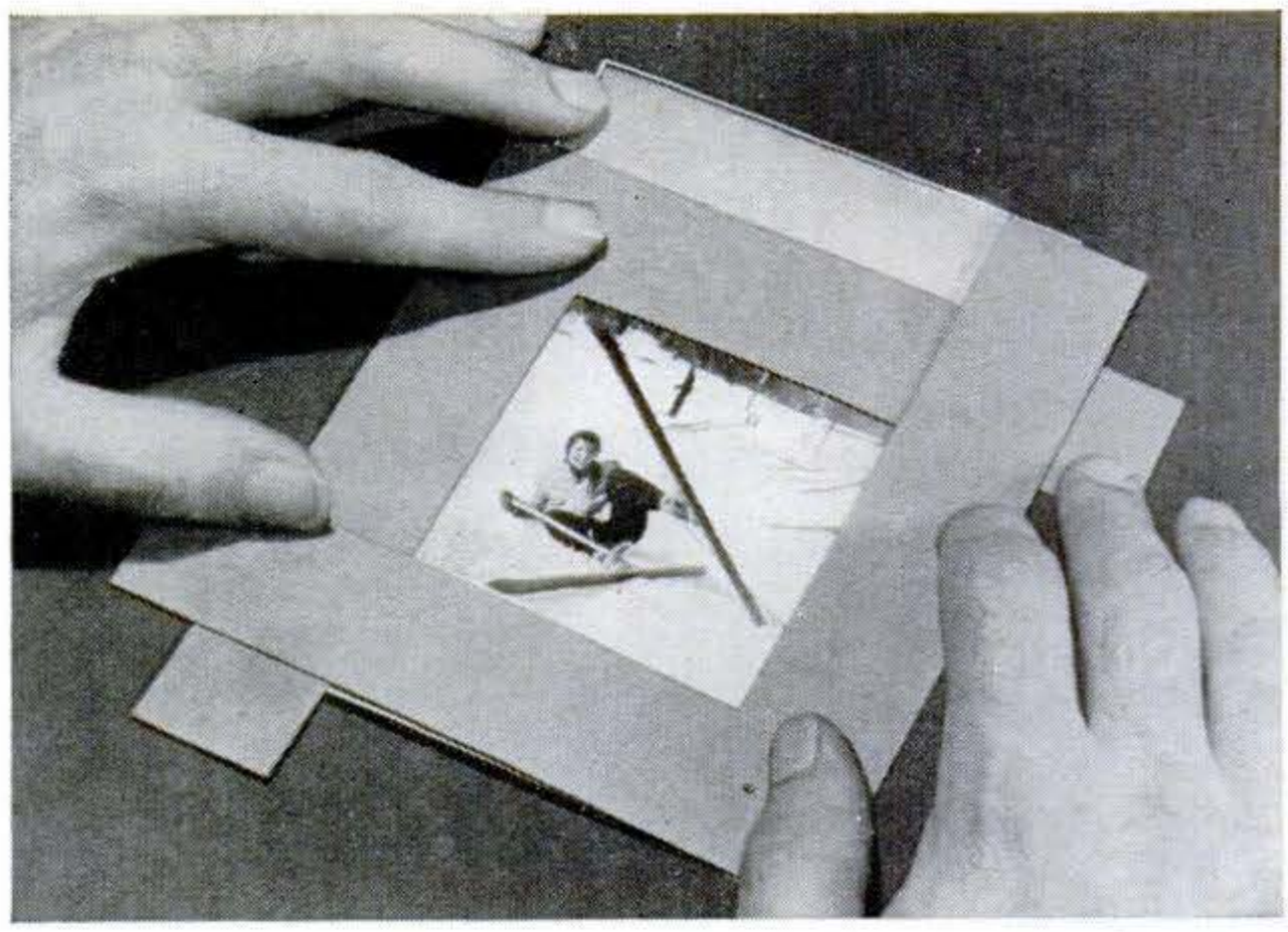
You'll find the difference between these pages explained on the next page.



...it's fun to make your album attractive

Start the new year right by laying out your pictures the way an editor would.

By Ralph Steiner



Trim each photo before mounting. Use L-shaped pieces of cardboard like this to find most interesting area.

DOES your photo album look drunk and disorderly? Does it follow the after-the-cyclone school of art? It needn't—if you know the rules. The care and feeding of the album can be an absorbing parlor game for the whole family.

Look at the two previous pages. The left-hand page is typical of many albums. It looks as though the pictures were pasted down just as they came from the photo finisher's envelope—first come, first pasted—in even rows like windows in a factory. But the page does have a unifying idea. All the pictures have to do with winter. In the same way, you can build your pages around such ideas as "The Birthday Party," "The First Trip in the New Car," and "Dorothy's Dresses from Birth to Marriage."

Pruning. The page was improved, as you can see, by pruning down the pictures to get rid of wasted space, then re-arranging them. It's easier for most people, including many professional photographers, to make good compositions by cutting down prints—instead of trying to do it in their finders when they snap the picture.

Two pieces of "L" shaped cardboard cut out of shirt stiffeners are handy marks in pruning. They can be shifted around on each print until all the uninteresting waste areas are framed away. In this case, we found much of the ice and snow areas could be cut away from the pictures without losing the feeling of winter.

Your eyes feel better looking at the cut-down pictures for much the same reason that your ears feel better when static is tuned out of a radio program. For photographers with an engineering bent, try thinking of yourself as picture engineers whose job is to make every picture 100 percent efficient.

The shot of the girl with skis was chosen as the most interesting and striking. To make it so, it was marked for a **blow-up** and given star position on the page. The picture of Junior with the hockey stick, when trimmed, came out an interesting shape. It too was set aside for enlarging and for second billing on the page.

Re-arranging. When the enlargements were ready, we found we had only one unusual shape. You may come up with many. But these may help, not hinder, you to arrange the pictures to make a page look different and intriguing. Long, thin strips can be run along the sides; a big round picture can be made the center for a circle of smaller photos.

Our four pictures of a small boy were grouped together. These, as well as the two squares of the girl skiing, were run edge to edge. This not only saved space but gave us a page with only four blocks of space to engage the eye.

White borders were lost in the trimming. But since our album page was black, we considered this a gain, because white borders on black pages can be more eye-catching than the pictures themselves. So off with them!

Two of our pictures went in the waste-basket. Even when ruthlessly trimmed, they looked like the two bad apples in the barrel. So out they went. If you haven't a surgeon's courage, reserve a few pages at the end of your album for such also-rans. But remember—always put your best photo forward. END

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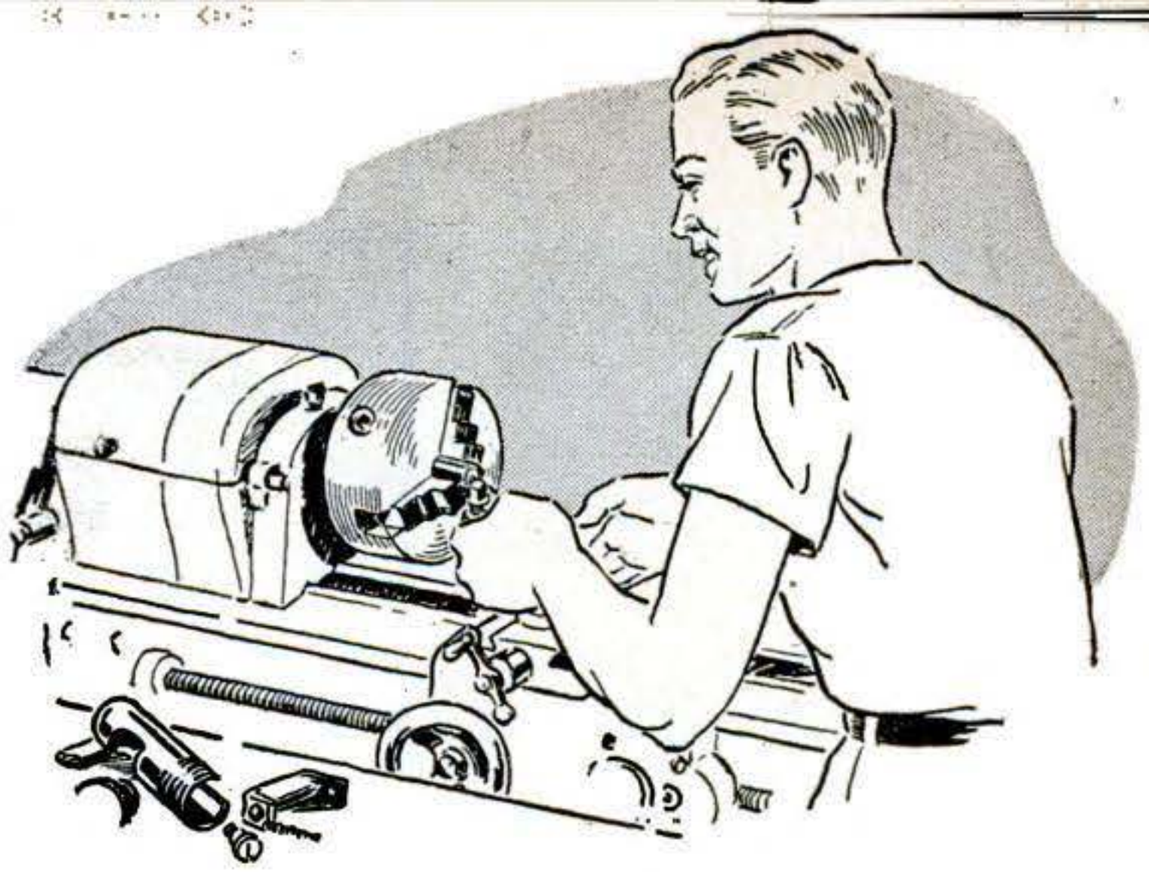
Turn Yourself a Lighter



Here's something you'll enjoy making as well as carrying in your pocket.

NO CIGARETTE lighter you buy can mean as much to you as one turned out in your own shop. It makes a fine project to keep your hand in between bigger jobs, or to learn basic techniques on a new lathe. This lighter works in wind, has a big fuel capacity, and is so sturdy and simple it will never get out of order.

Monel metal is the ideal material, but stainless steel, bronze, or even brass will do. You can make the sparking wheel by knurling a piece of 7/16″ drill rod and hardening it, or take a wheel from an inexpensive new lighter.

Tank top. Chuck stock with more than enough protruding to make the entire piece. Face, turn the edge radius and wick tip, and turn the shoulder with a parting tool. File smooth and polish with emery cloth before parting off.

Tank. It's easier to make this of tubing than solid stock. Chuck a 3″ length of thick-walled tubing (with a maximum bore of ½″) so that about 2″ projects. Turn the outside, and bore carefully to a tight fit for the tank top. Cut the threads on the lathe too.

Plug. Leave enough out of the chuck to turn, thread, and cut off with a slight allowance for facing the knurled end afterward. File the knurled edges slightly.

Screw the plug snugly into the tank and insert the top. Put wooden pads against both ends; then squeeze the assembly in a vise to press the top home.

Post holder. Bend a 5/16″-wide strip of 1/16″ stock lengthwise over a piece of steel 11/16″ in diameter. This is to produce the curve matching that of the tank. Then clamp it to the steel to bend up the ends. Drill the four holes, taking care that the two larger ones are accurately located to hold the post parallel to the tank.

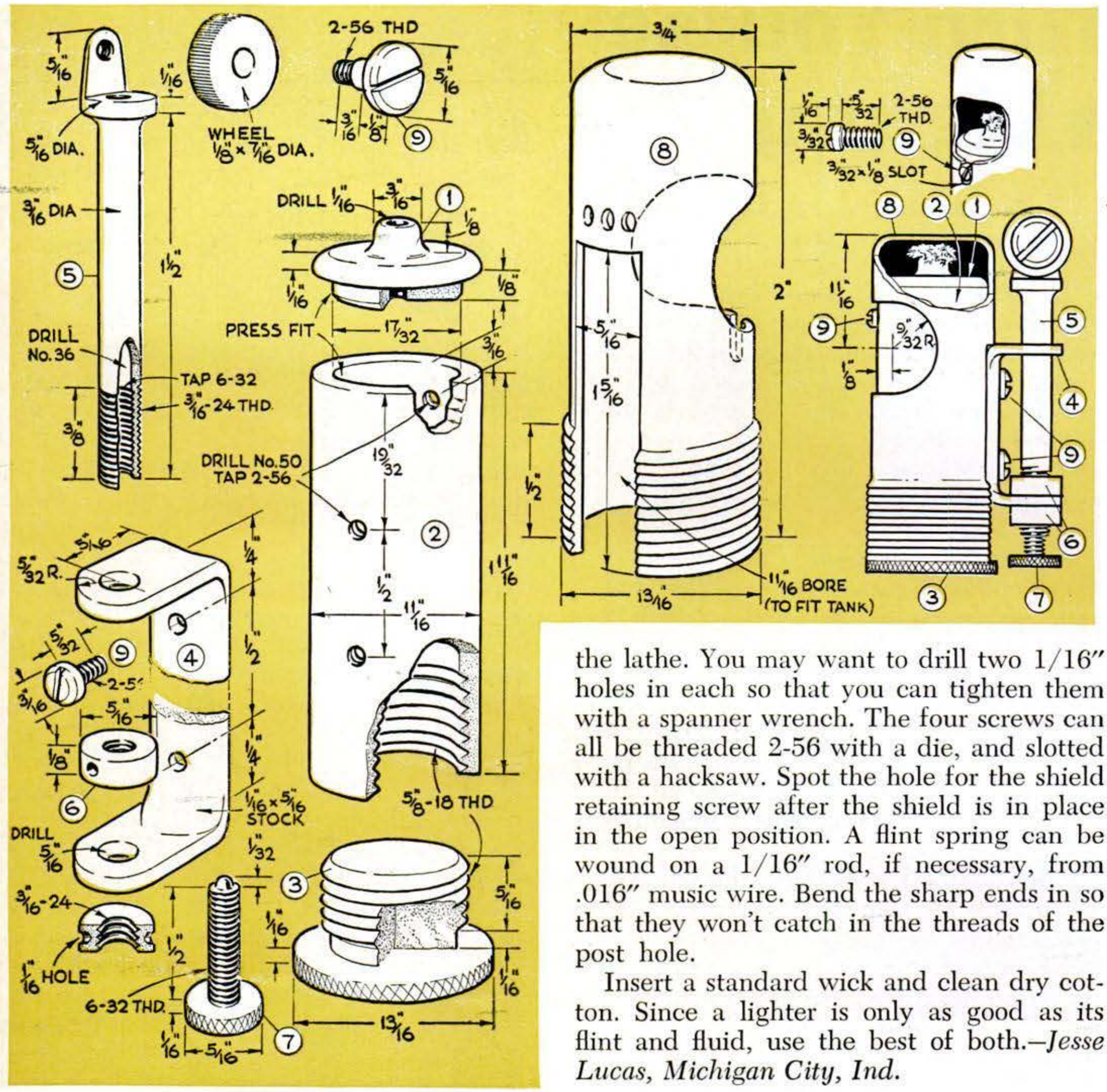
Post. Leaving 1 9/16″ of a piece of 5/16″ rod out of the chuck, centerdrill, and run a No. 36 hole through. Tap 6-32 to ⅜″ depth. Then turn to 3/16″ diameter for 1½″. Cut the outside thread almost full, finishing with a 3/16″-24 die. Polish and cut off.

Check your wheel size before shaping the top of the post. Spot the shaft hole to leave minimum clearance under the wheel, to insure using all the flint.

Shield. You can bore this from solid stock, or use tubing and silver-solder a plug into the top. Bore the inside to a smooth sliding fit on the tank. Use a pointed threading tool to make the gripping rings at the lower end. You can space them .050″ apart by swinging the compound parallel to the lathe ways and using its feed. Turn rings .025″ deep, round each one on top with a fine file, and polish.

File the flame opening to a depth of half the diameter. Slide the shield on a rod or dowel to drill out the slot at the back. File the slot to size. The three air holes above the slot can be drilled after assembly, if needed.

Fittings. The two round lock nuts that hold the post can be drilled and tapped in



the lathe. You may want to drill two 1/16″ holes in each so that you can tighten them with a spanner wrench. The four screws can all be threaded 2-56 with a die, and slotted with a hacksaw. Spot the hole for the shield retaining screw after the shield is in place in the open position. A flint spring can be wound on a 1/16″ rod, if necessary, from .016″ music wire. Bend the sharp ends in so that they won't catch in the threads of the post hole.

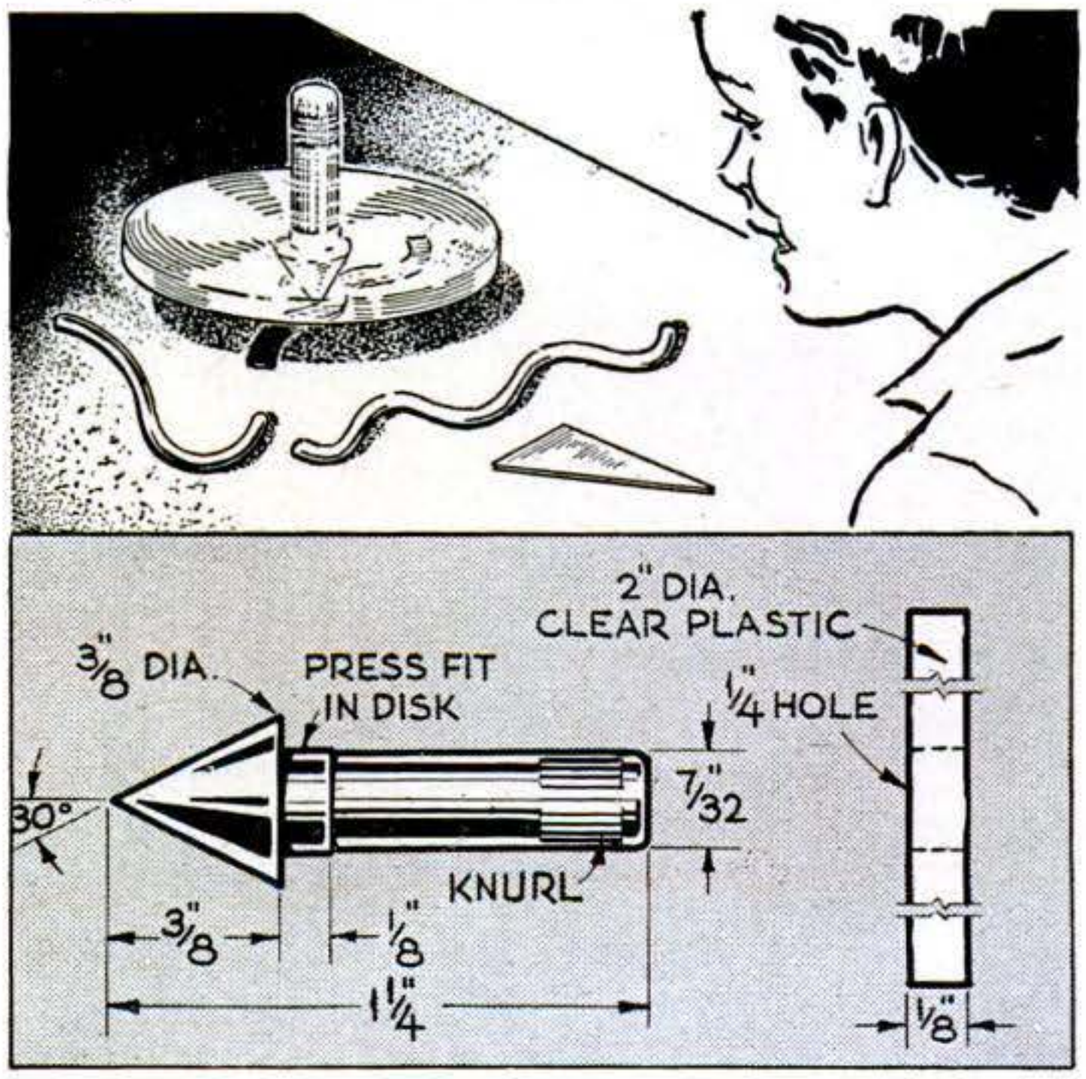
Insert a standard wick and clean dry cotton. Since a lighter is only as good as its flint and fluid, use the best of both.—*Jesse Lucas, Michigan City, Ind.*

Magnetic Top Shows Action Through Plastic Disk

IN HALF an evening you can make this unusual toy for the children. It should keep them busy for hours.

The top is given a hard finger-tip spin on a smooth surface. Then bits of ferrous wire, nails, or tin-plate cutouts are pushed against the turning point. Magnetism and friction take over, endowing the pieces with a curious motion of their own as they "walk" along the spinning point. The action is completely visible through the transparent disk, so the kids miss none of the fun.

Turn the shaft from ⅜″ drill rod with a shoulder for the disk. Heat it to redness and quench to harden it. Magnetize it by rubbing it on a strong magnet. Press the disk on, and if necessary turn the edge down so it runs dead true.—*J. C. Magee, Schenectady.*



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You Can Have Direct Current in Your Shop

It pays the craftsman to know what can be done with selenium rectifiers.

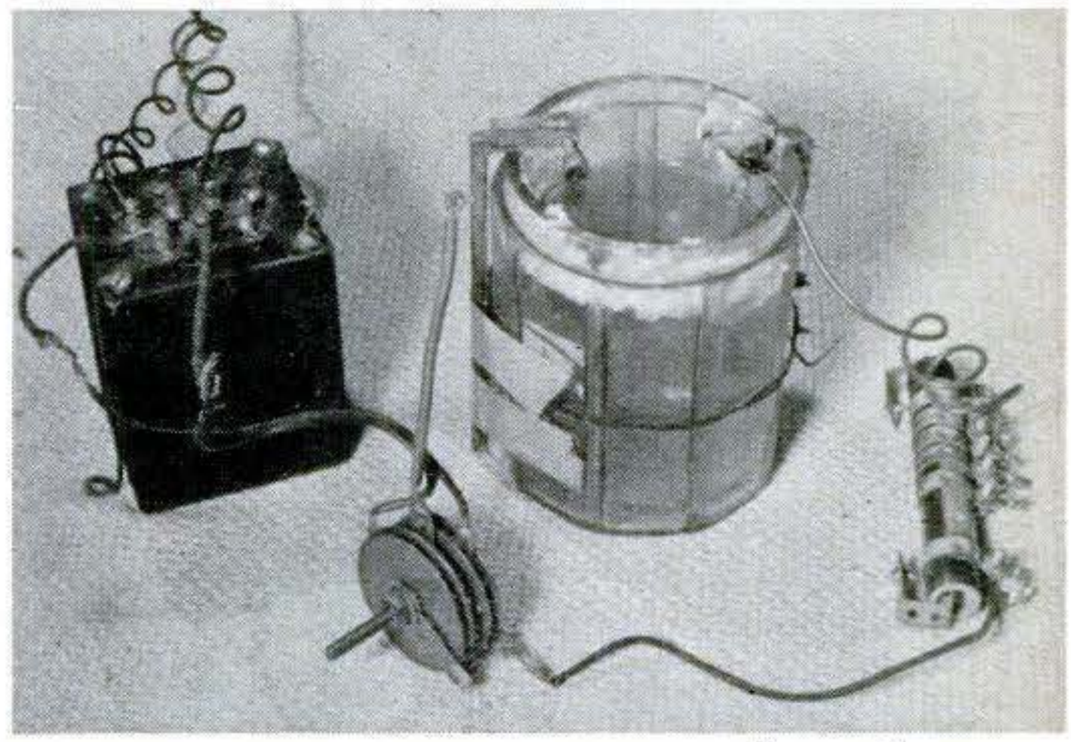
By Ray Millholland

RUMMAGING in surplus stores, you may still find high-quality, ball-bearing motors, so well built they'd delight any mechanic's heart. Prices are low. But those motors stay on the counter, for the name plates say "Direct Current."

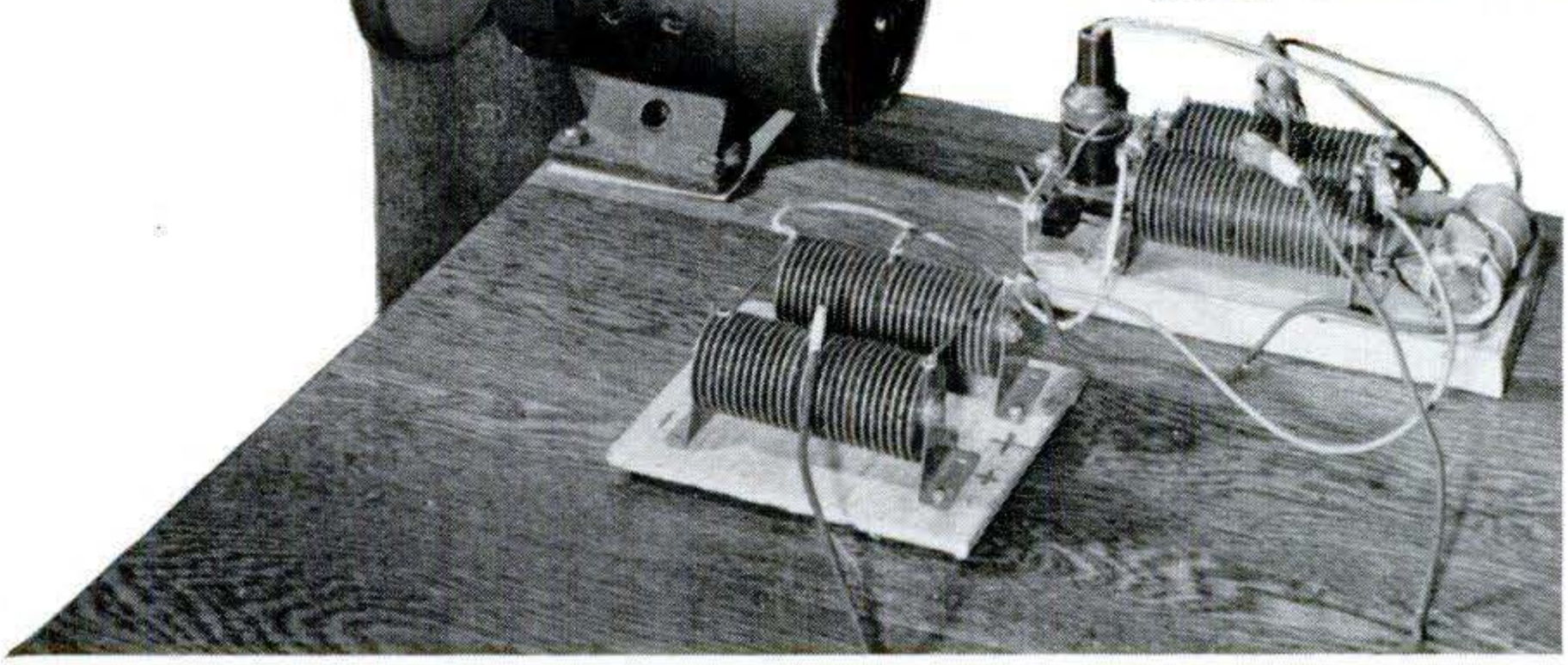
You may have wished you could recharge your car battery right in the garage when it needs a boost. Perhaps you've thought of taking a crack at electroplating. And some day you may plan to have a two-rail miniature railroad layout. But all these things also require direct current, and the only place you have DC is in your flashlight.

Stymied? Not at all. You have ample power in your AC house lines, and you can turn that kind of juice into direct current. Selenium dry-plate rectifiers, which are a row of disks or plates between mounting brackets, will do it.

Maybe you've passed these devices by on the counters because there wasn't a name



Electroplating setup consists of small transformer and the full-wave rectifier diagramed in Fig. 9. Four disks are stacked on an insulated bolt. The resistor at right in the photo adjusts current to suit various sizes of work.



Power buffing with a DC motor driven from the house AC line. High-quality motors of this sort sometimes go for bargain prices. The four rectifiers, which safely deliver up to 2 amp., should be used in the open for ventilation.

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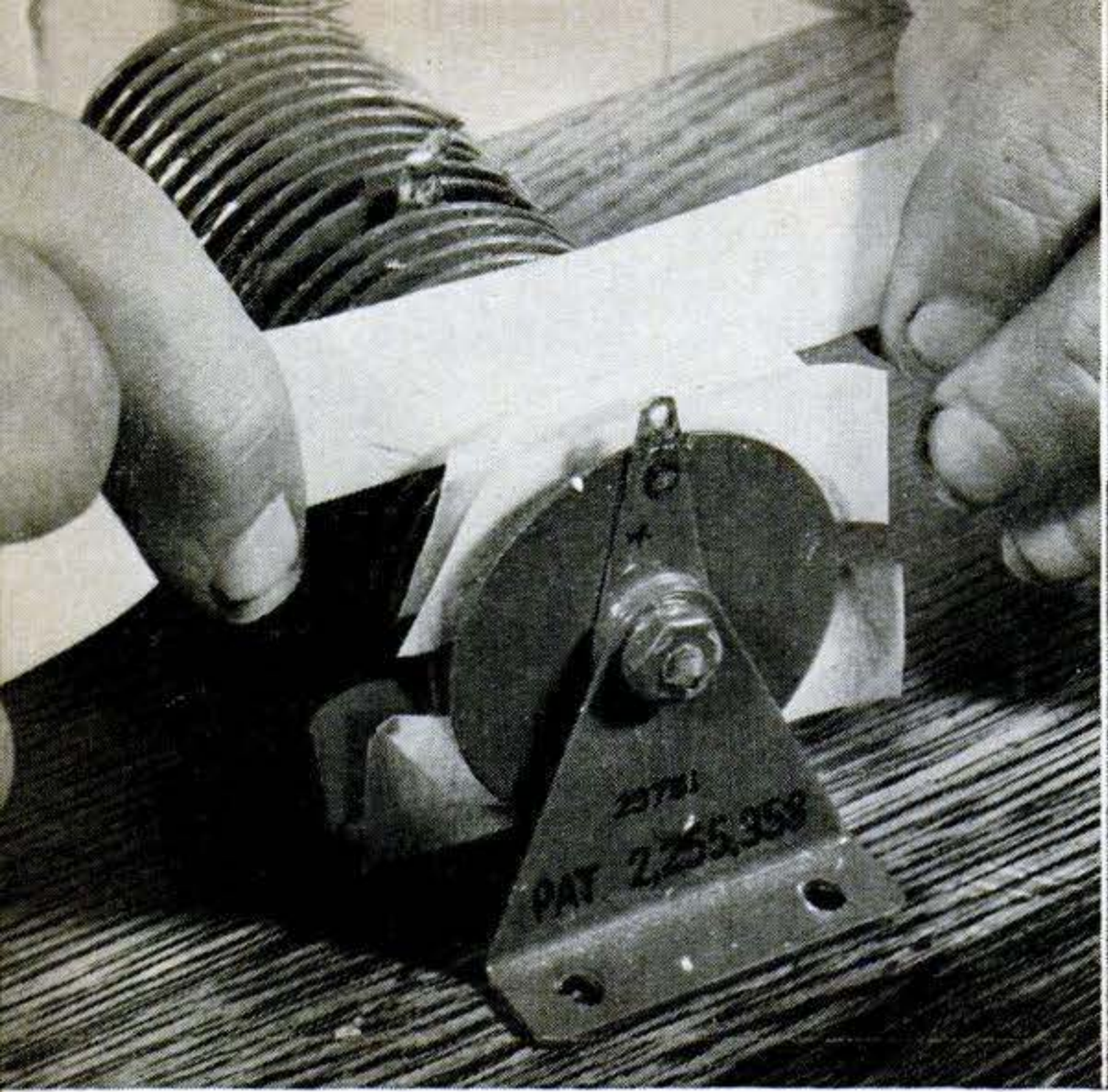

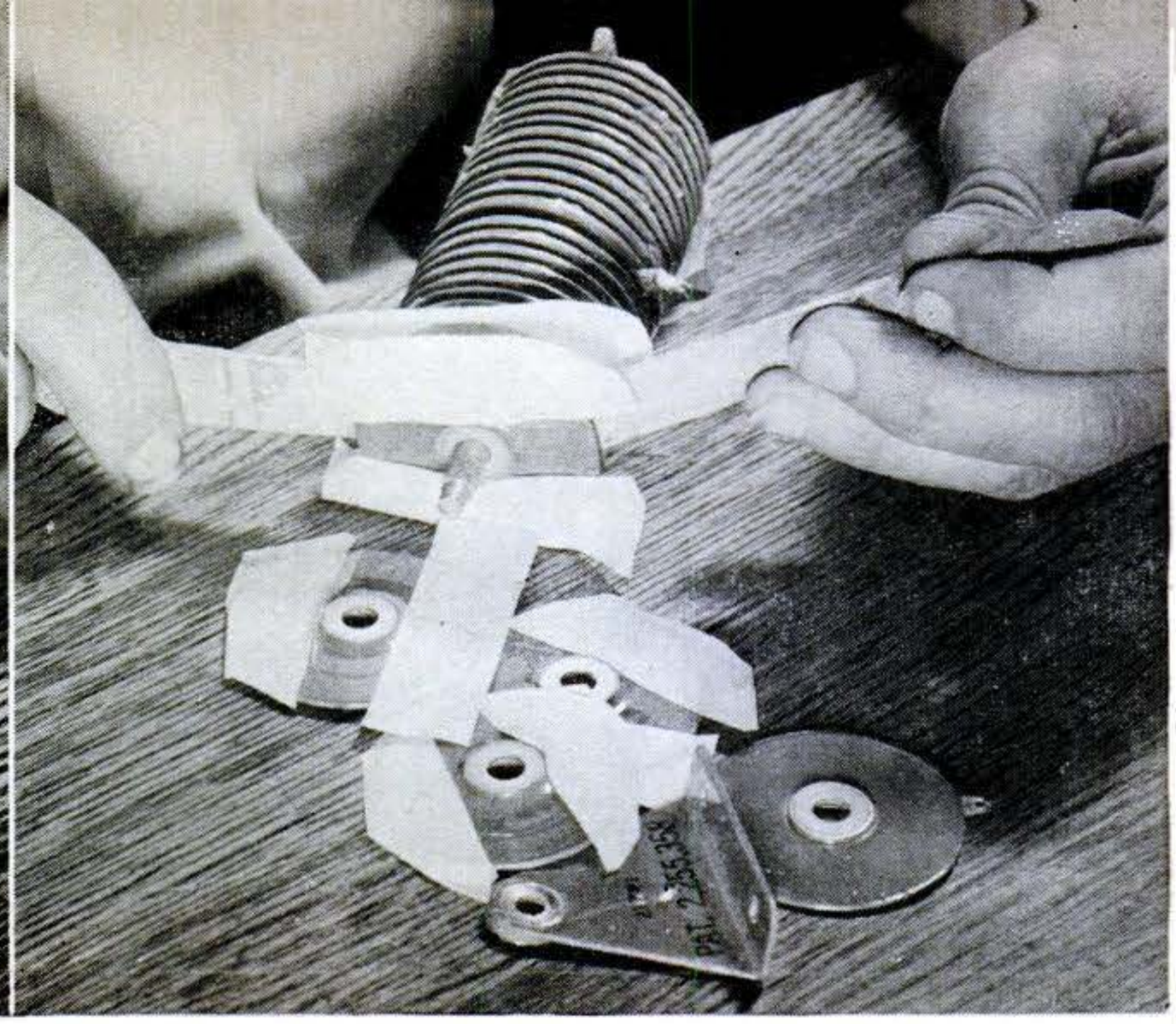

First step in taking apart rectifier stacks is to tape each disk on the brass-electrode side like this. Then the taped disks are pried off the through bolt with paddles, as shown above.

plate—no clue to what voltage or current they'd handle, or how to hook them up. Here's the dope:

One-way conductors. Basically, any rectifier acts like a check valve in a water

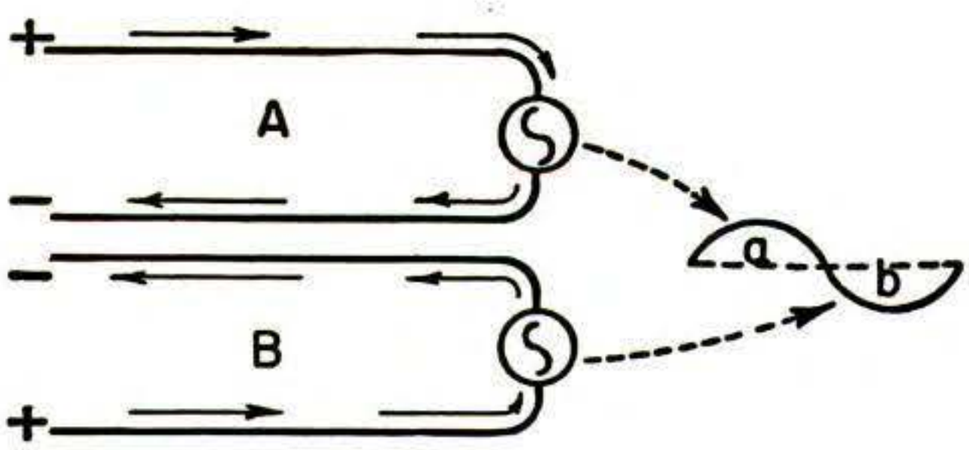

FIG. 1

pipe—it will let juice pass in only one direction. Familiar 60-cycle AC flows alternately first one way and then the other, 120 times a second. In an ordinary lamp circuit, for instance, (Fig. 1) it flows first as in *A*, and 1/120 second later reverses itself as in *B*. Graphically this action is represented by the two loops *a* and *b*, and the resulting wavy line is called a sine wave.

Put a rectifier in the circuit as in Fig. 2, and current can flow only in one direction. It doesn't flow all the time; the one-way valve just cuts off half of the sine wave, and you have an intermittent or pulsating direct current. For lots of applications this is all right. When you need the whole wave, you can hook up another rectifier to get the other half as well.

The basic unit of a selenium rectifier stack is a little sandwich shown in cross section in Fig. 3. The back electrode is a steel plate coated with selenium. Clamped to it by an insulated bolt is a brass contact disk.

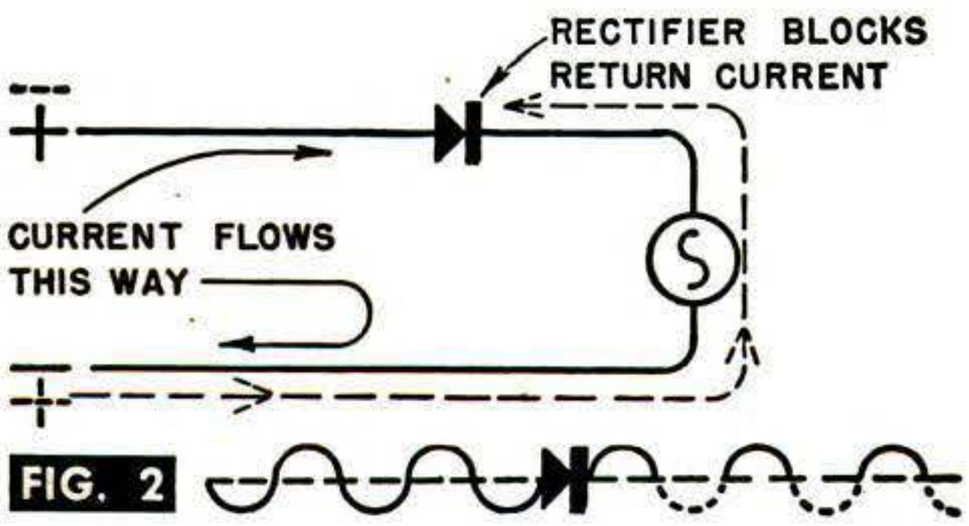

FIG. 2

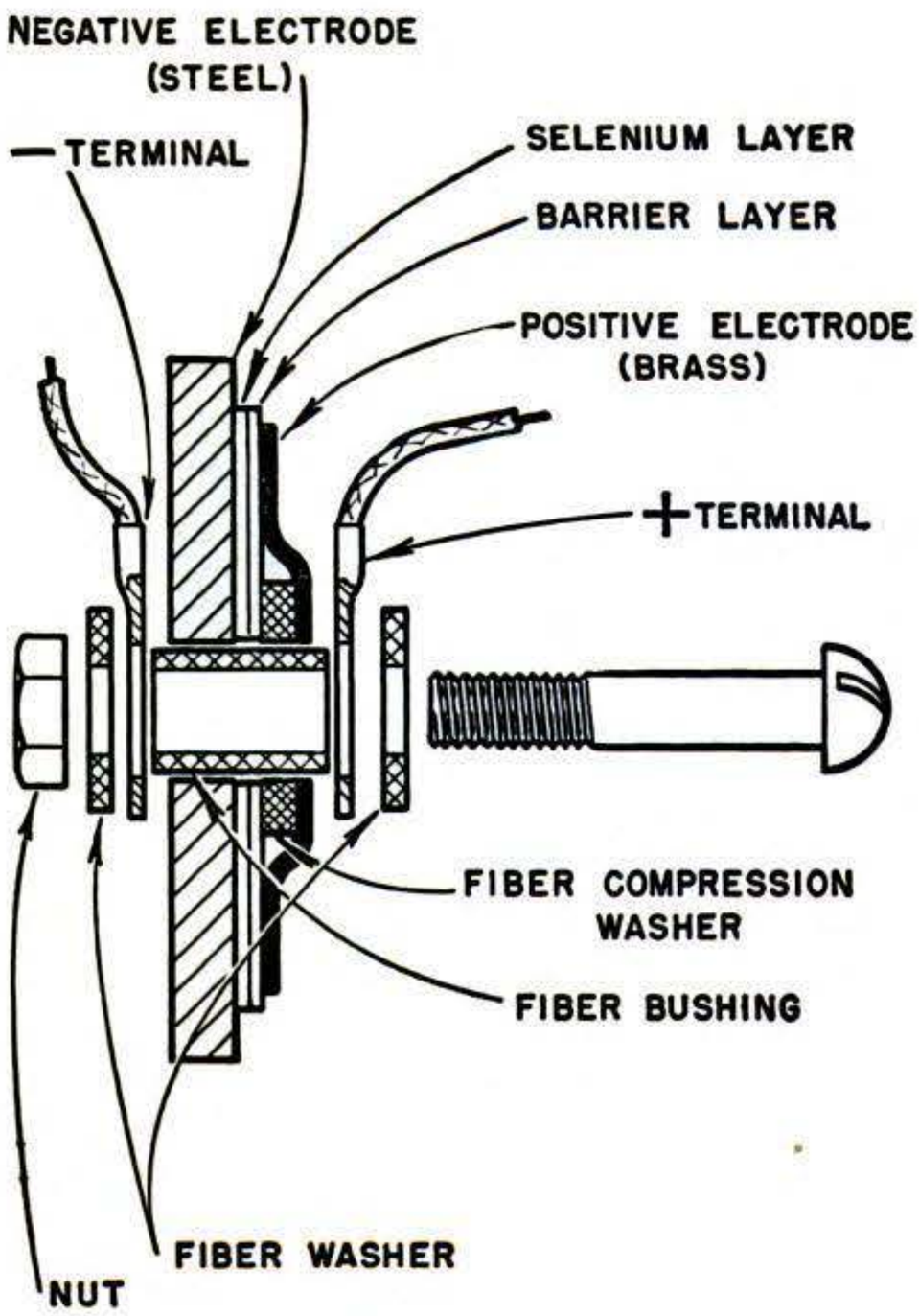

FIG. 3

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An element like this will stand 12 to 16 volts of reverse potential—which means that above this, it may not do its check-valve job. To rectify higher voltages, you use two or more elements in series.

The amount of current (amperage) an element will handle is limited by the heating effect, which depends on the disk size and cooling area. The bigger the steel plate, the more juice it will handle. Disk temperatures should not exceed 160° F. You can increase capacity by clamping extra cooling fins to the plates, by playing a fan on the stack, or by both.

Taking a stack apart. The 24-plate unit shown in the photos is a typical surplus item. The disks are 1¾" in diameter. It's rated at 120 volts, .22-amp. output. But this rating is for use in a confined space; out in the open the disks will handle .5 amp. nicely. With fins, and fan cooling, they'll handle up to 1 amp.

If you want line-voltage output, you'll use the stack as it is, but for lower voltages it's taken apart and rebuilt. Apply two strips of cellulose tape firmly to the positive side of each cell, or plate, as shown in one of the photos. This prevents the thin brass electrode from pulling off the selenium layer.

Now you can remove the nut on the end of the stack and pull the long bolt out of the fiber tube or bushing on which the plates are stacked. Then, with tongue depressors or similar wooden paddles, pry off the disks one at a time. You'll wind up, in this case, with 24 separate rectifiers.

Figure 3 shows a single cell with the necessary fiber bushing (cut off the original long one), washers, and terminal lugs. The bolt is completely insulated from all parts of the rectifier by the bushing and fiber end washers. This single plate, hooked up in a series circuit, would give you half-wave rectification, safely delivering up to 12 volts and .5 amp.

Should you want to draw up to 1 amp., you could fan-cool this single disk, or use two disks in parallel as in Fig. 4. The two could be mounted separately, or stacked on a single bolt *with an insulating washer between them.*

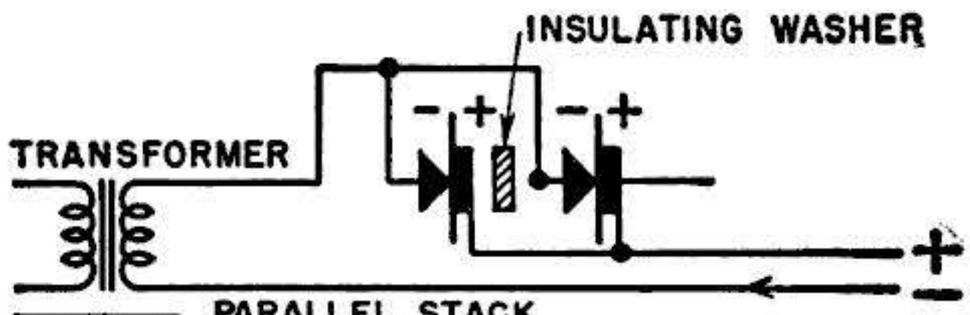

FIG. 4 PARALLEL STACK 12 VOLTS, 1 AMP. (HALF WAVE)

Half-wave 24-volt unit. For running 24-volt DC motors, charging batteries, and many other jobs the half-wave, intermittent DC diagramed in Fig. 2 will serve nicely.

Since a single plate will stand 12 volts of reverse potential, you need two in series to handle 24 volts. If your load won't be more than .5 amp., simply assemble two plates on a bolt, so that the brass disk of one cell clamps against the steel disk of the other, as in Fig. 5.

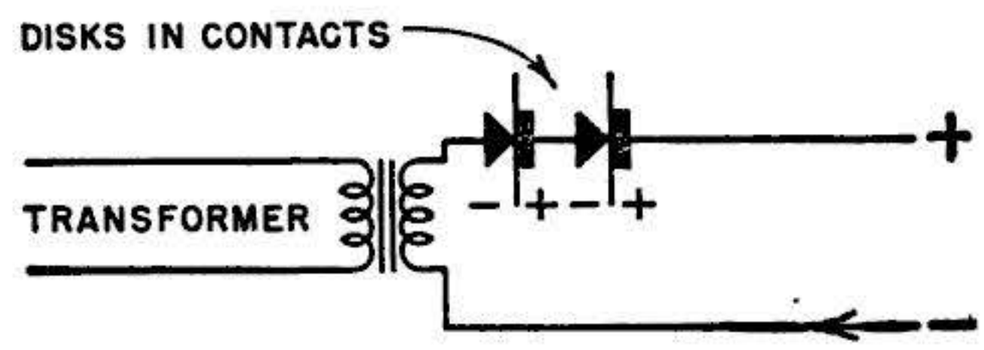

FIG. 5 SERIES STACK 24 VOLTS, .5 AMP. (HALF WAVE)

To get 3 amp. at 24 volts, you'd simply connect six such two-plate pairs in parallel (Fig. 6). The two plates of each pair touch, but each pair is separated from the next by insulating washers, as shown in the diagram. All the positive (brass) plates are connected to a common bus bar, and all the negative (steel) plates to another.

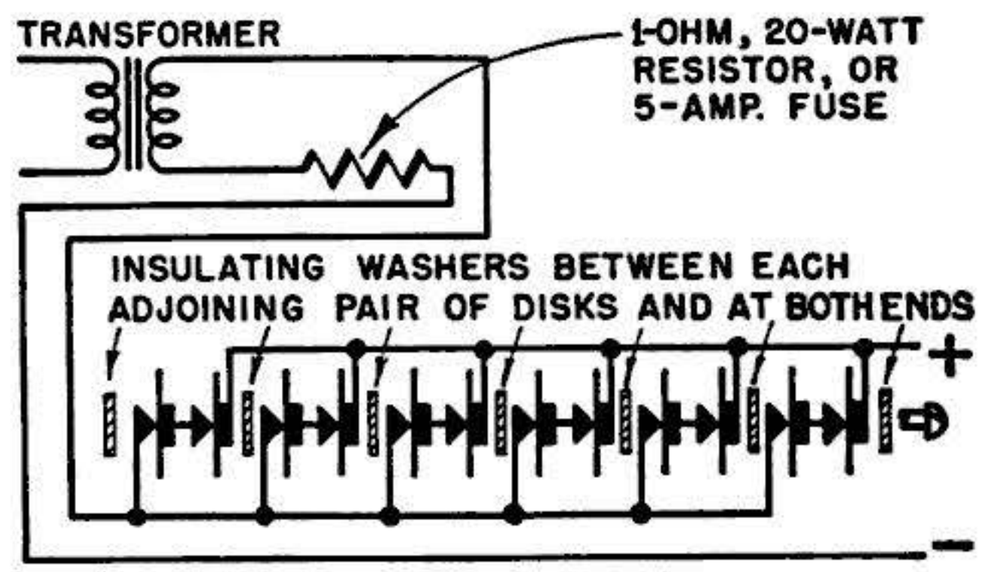

FIG. 6 SERIES PARALLEL 24 VOLTS, 3 AMP. (HALF WAVE)

Battery trickle charger. To pep up a car battery overnight, you can build this 3-amp. charger (Fig. 7) from six rectifier disks and a small constant-duty transformer rated at 75 watts or better. Clamp up the

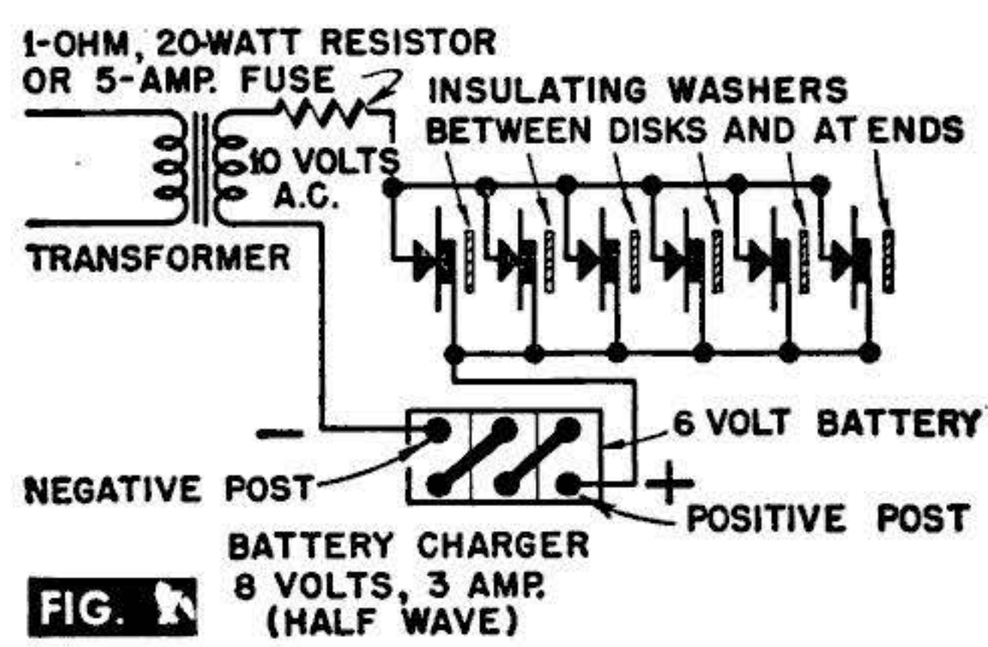

FIG. 7 BATTERY CHARGER 8 VOLTS, 3 AMP. (HALF WAVE)

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disks with insulating washers between all of them, and connect all positive sides to a common lead (which will go to the positive battery post). All the negative electrodes are common to one side of the transformer, which should have a 10-volt winding. Put a 5-amp. fuse in the output line to protect the rectifier and transformer in case of a

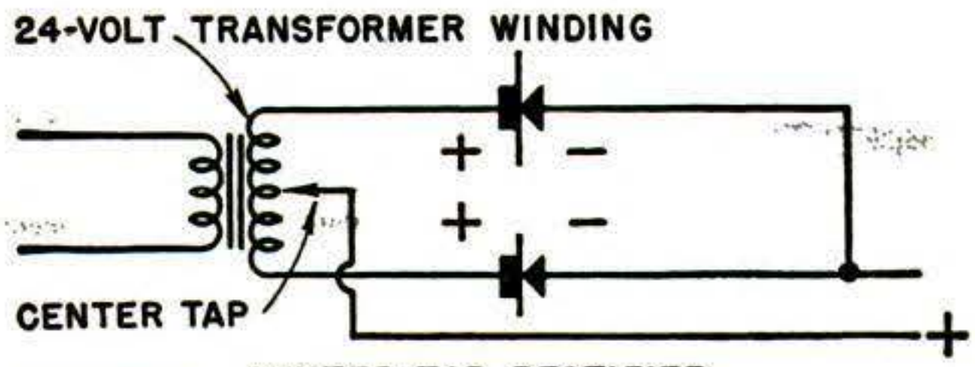


FIG. 8 CENTER-TAP RECTIFIER 12 VOLTS, .5 AMP. (FULL WAVE)

short, or else provide a limiting resistor.

Getting the full wave. For electroplating, hum-free relays, and other applications that need full-wave rectification, you can hook up the disks in two ways. The simpler calls for a transformer with a center-tapped secondary. Most radio filament transformers are this type. The basic circuit is the one shown in Fig. 8 on this page.

Here the two outside leads of the transformer secondary go to the positive (brass) electrodes of two rectifier disks, mounted on a common bus bar or metal strip joining their negative electrodes. This bus bar becomes the negative DC lead; the center tap of the transformer, the positive.

Your DC output will be about half the AC voltage across the transformer secondary, so you'll need a transformer giving 24 volts if you want 12 volts DC. What happens here is that half the sine wave scoots through one rectifier, and the other half (blocked by the first disk) goes through the second. Although this type of circuit isn't recommended for more than 12 volts, you can get more amperage by stacking disks in parallel.

Full-wave bridge circuits. In these, the disks are assembled like two half-wave rectifiers with their positive terminals in contact at the middle of the stack (Fig. 9).

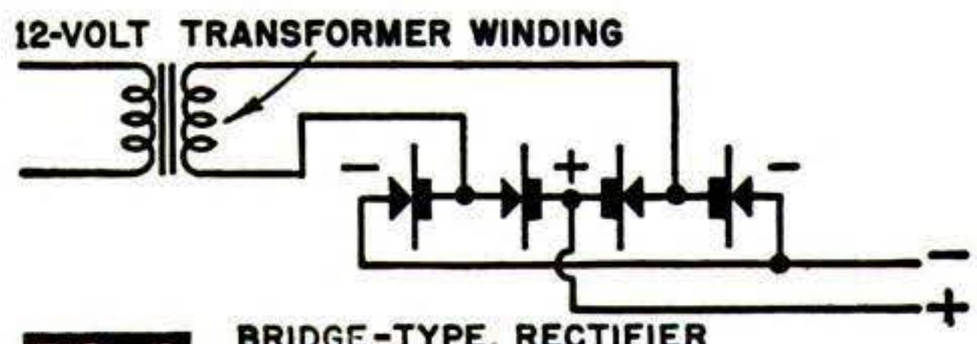
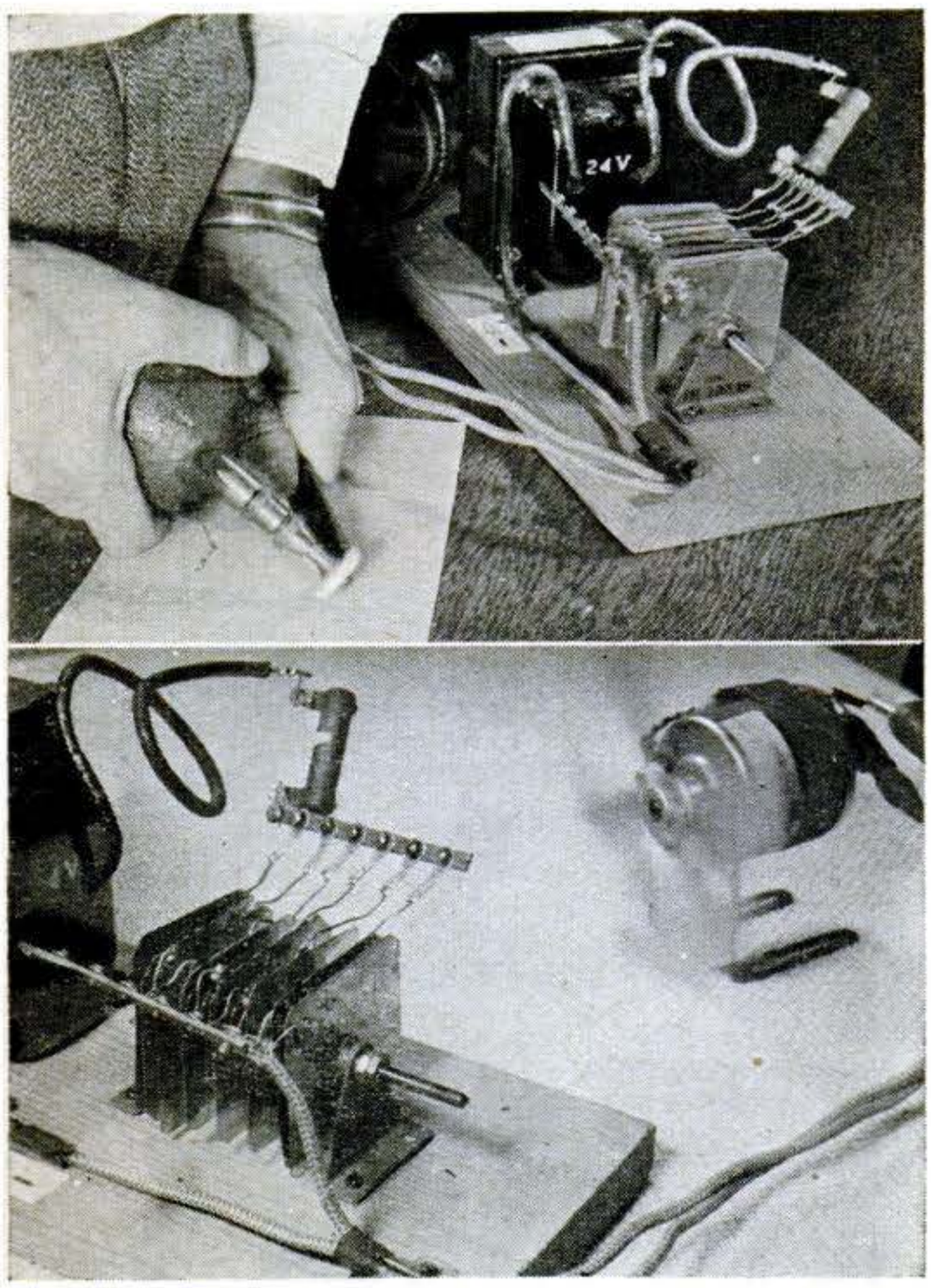


FIG. 9 BRIDGE-TYPE RECTIFIER 12 VOLTS, 1 AMP. (FULL WAVE)

The AC input straddles the center pair. The two negative end electrodes are joined to form the negative DC lead. Each disk is subject to the full working voltage, so 12 volts is the rating for the circuit.

For higher outputs, add more disks in series or parallel as required. For 24 volts, 1 amp., you'd need two 1¾" disks in series (one behind the other) for each one shown in Fig. 9. For 2 amp. and 12 volts, you'd connect two disks in parallel (side by side) for each one shown.

Using the whole stack. For 115-volt DC motors, solenoids, and the like you can use 24-plate stacks as they come, either by connecting up just half a stack as a simple .5-amp. half-wave rectifier, or by hooking up two stacks as a full-wave bridge rectifier



Surplus 24-volt aircraft motor makes a husky hand grinder when run from a half-wave rectifier. Tin-plate disks 2½" square clamped alongside the steel disks and extra spacer washers between the plates increase current capacity by 25 percent. A small cooling fan blowing on rectifier will double load capacity for brief periods.

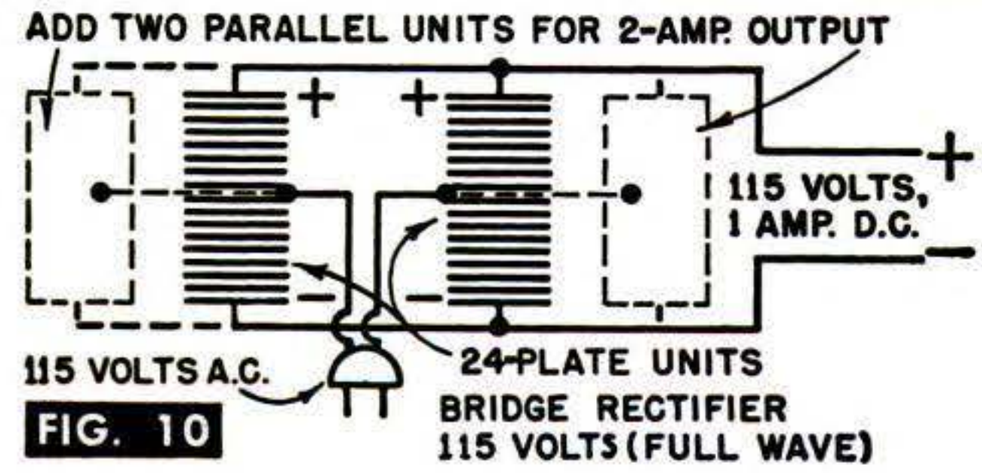


FIG. 10

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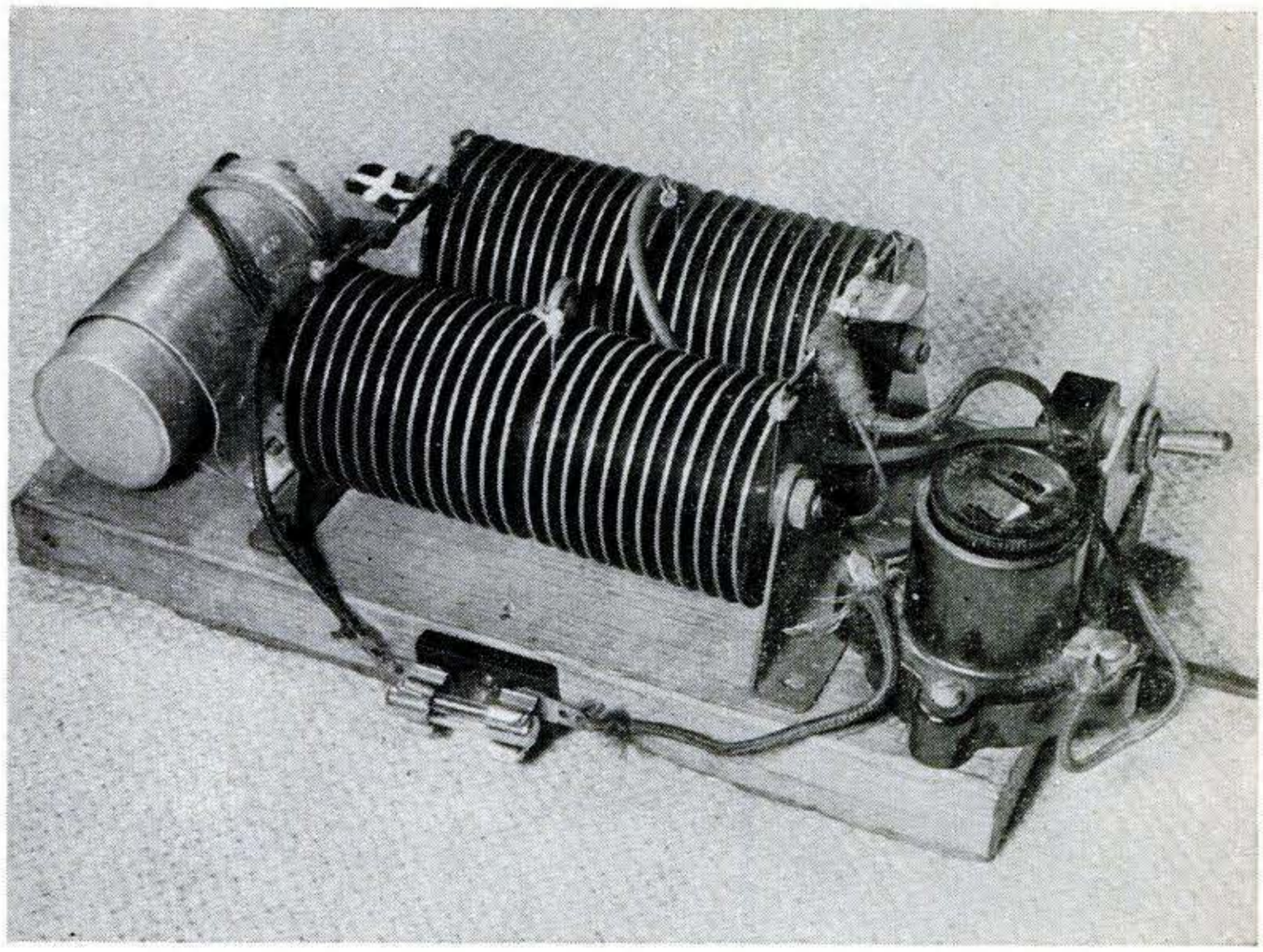
You can run small 110-volt DC motors with this unit. Two 24-plate stacks are hooked up in a full-wave circuit (Fig. 10). The 60-mfd. capacitor improves the voltage regulation.



(Fig. 10). For 2 amp. at line voltage, add two more stacks as shown by dotted lines.

Measuring output voltage. A DC voltmeter put across an unloaded rectifier will show a lower reading than you'd expect. It will read higher when the rectifier is working at normal load. However, on halfwave DC the meter will never show peak voltage, but only the average.

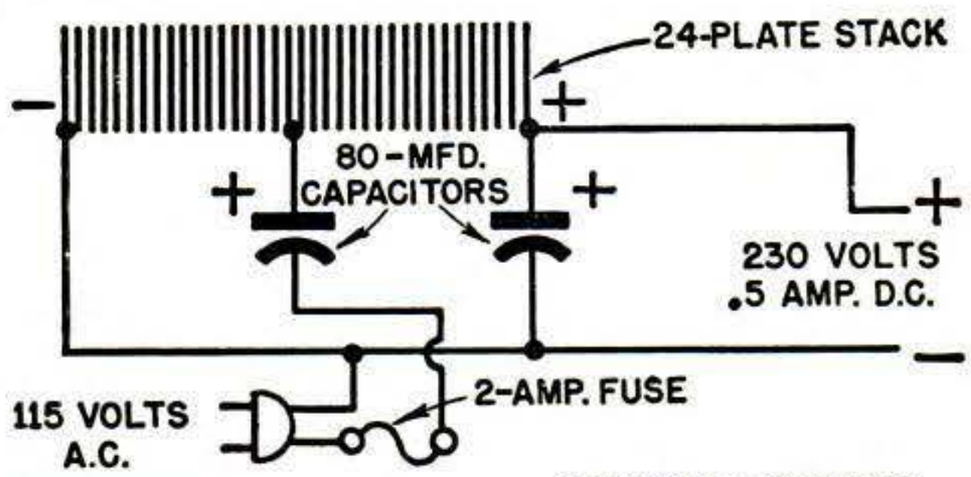


FIG. 11 VOLTAGE DOUBLER (HALF WAVE)

Less voltage drop under load can be had by connecting an electrolytic condenser across the DC output. Use a 60-mfd. condenser or larger if possible. Remember that electrolytic condensers have a plus and a minus side, and connect them accordingly.

Voltage doubler. You can get 230 volts from a 115-volt line with the circuit shown in Fig. 11. One of the two condensers is charged on half of the sine wave, and adds its charge to the line voltage on the second half. Be sure to use a 2-amp. fuse in the 115-volt side. END

WOOD-GRAIN TERMS

Close grain—Narrow and inconspicuous annual rings. The term is sometimes used to designate wood with small and closely spaced pores, but "fine textured" is more common for this.

Coarse grain—Wide and conspicuous annual rings with marked difference between springwood and summerwood.

Cross grain—Where the cells or fibers do not run parallel with the axis or sides of a piece.

Diagonal grain—Annual rings at an angle with the axis of a piece as a result of sawing the log at an angle.

Edge or vertical grain—Lumber in which the rings form an angle of 45° or more with the surface of the piece.

Interlocked grain—Wood in which the fibers are inclined in one direction in a number of rings of annual growth, then gradually reverse and are inclined in an opposite direction in succeeding rings, then reverse again.

Flat grain—Lumber in which the rings form an angle of less than 45° with the surface.

Open grain—Common classification of painters for wood with large pores, also known as "coarse textured."

Spiral grain—A type of growth in which the fibers take a spiral course about the bole of a tree instead of the normal vertical course. The spiral may extend right or left-handed around the tree trunk.

Wavy grain—Wood in which the fibers collectively take the form of waves or undulations. (From the National Lumber Manufacturers Association.)

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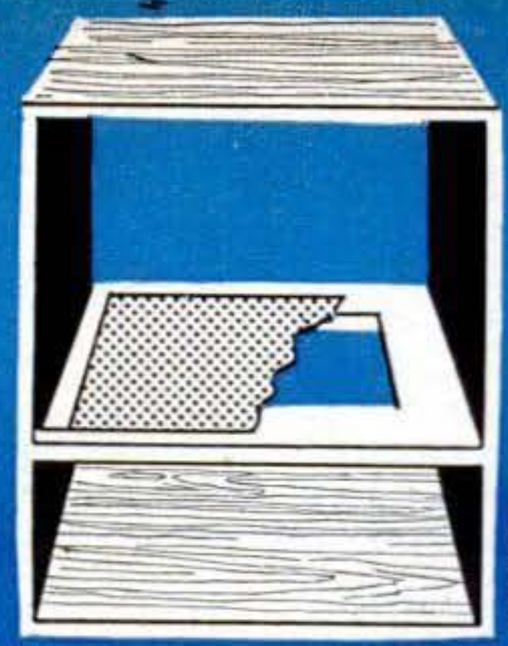
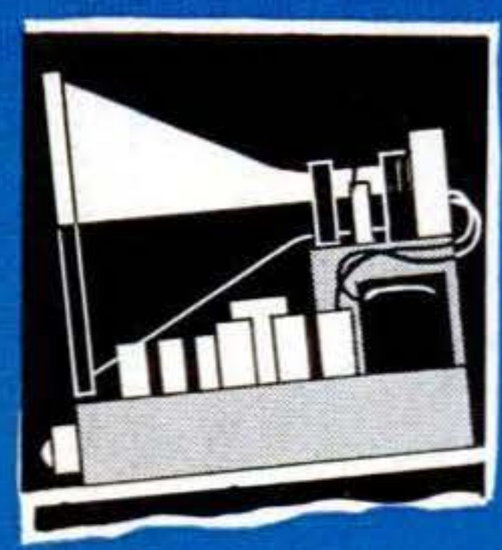
Tips for TV Cabinet Builders

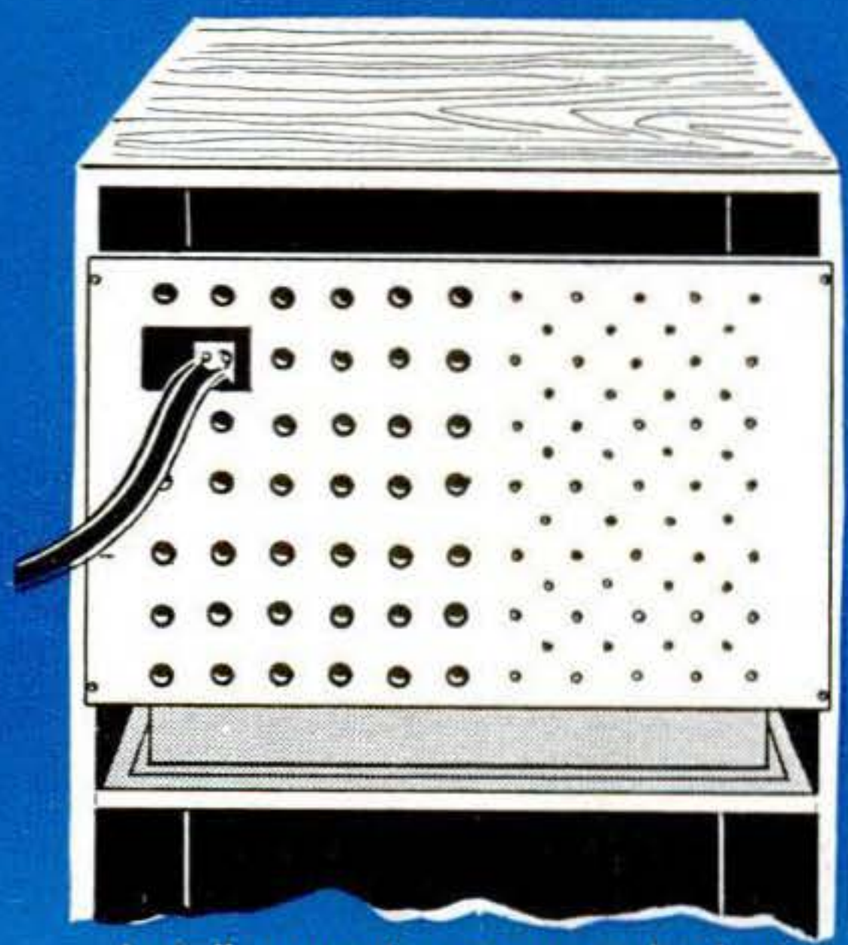


Allow for ventilation. Be sure there's air space below the shelf on which set rests. Drill holes in shelf, or, better, cut a large opening and cover it with heavy metal mesh.

Keep parts accessible for servicing. Each unit should be removable without disturbing others. Connect units with polarized plugs and sockets.



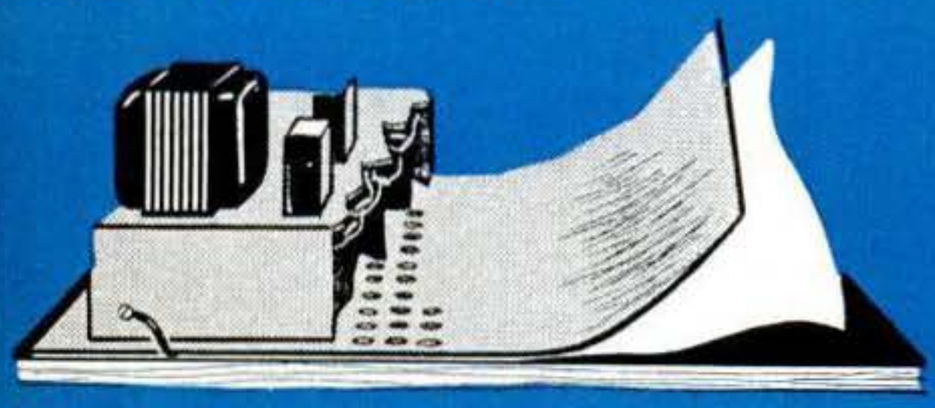
Minimize glare on picture. Tilting the chassis forward about 4° and letting cabinet overhang the picture tube at top will help to cut light reflection.



Install protective cover on back. It must combine safety with maximum ventilation; 3/8" holes will stop most flying glass. Near high-voltage circuits make holes 3/16".

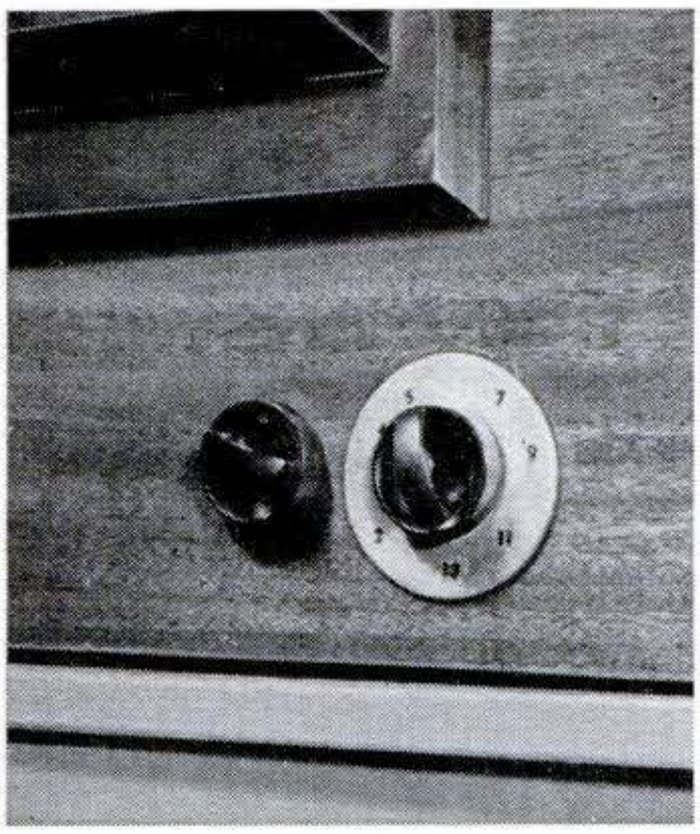
Consider viewing angles. If it won't be convenient to move chairs around the set, use a rotating base. You can buy a commercial swivel or make a ring and disk as shown.

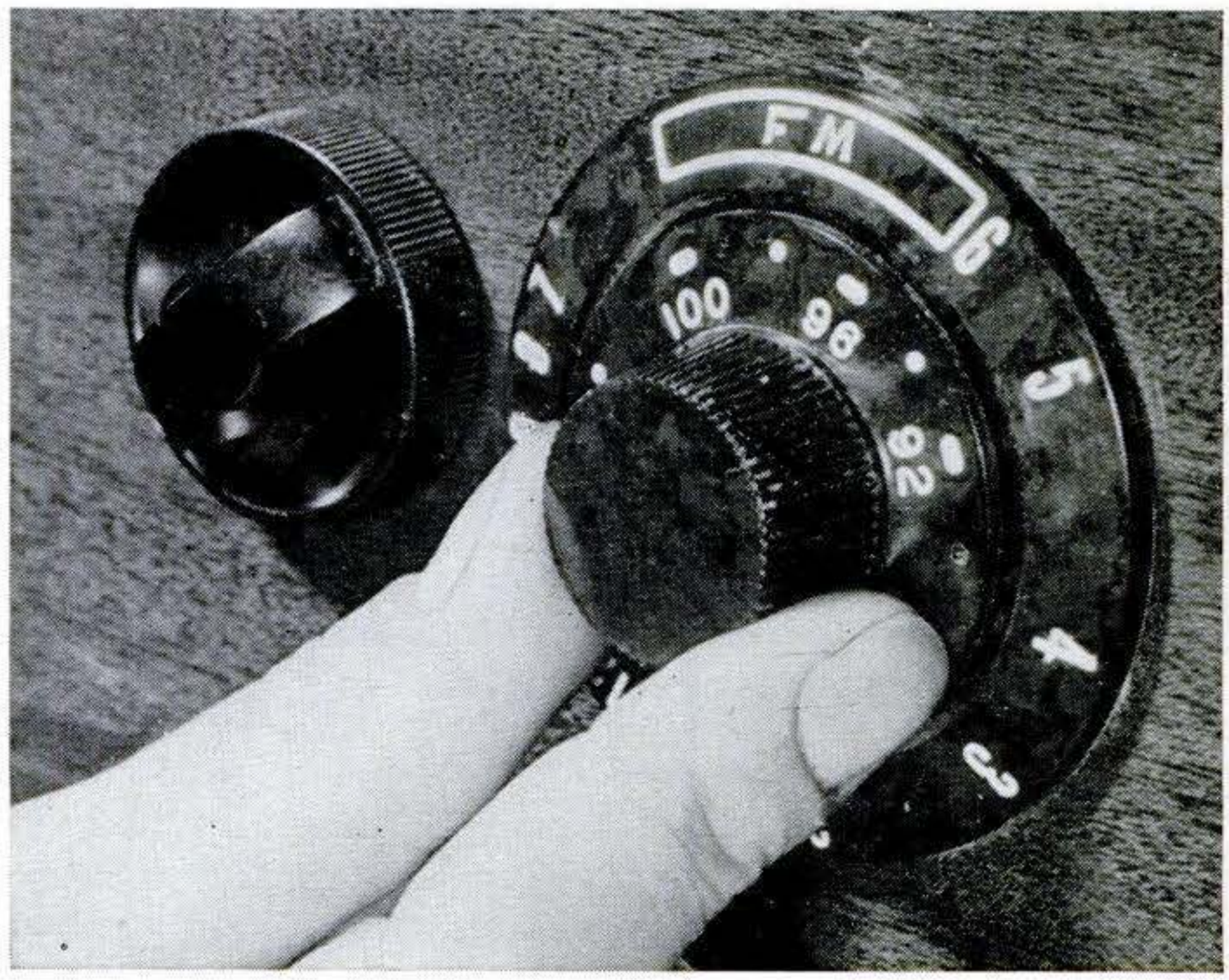
Guard against voltage leaks that may make front of set "hot." Use neoprene, not rubber, for metal-tube supports.



Shield the bottom of the set to reduce noise pickup. Easiest way is to line chassis shelf with aluminum foil and cover foil with cardboard. Connect chassis to foil. Punch vent holes through all layers.

Trim speaker-grille cloth. Most speaker cloths have metal fibers. If loose threads straggle into contact with high voltage, your set may become dangerous to touch.





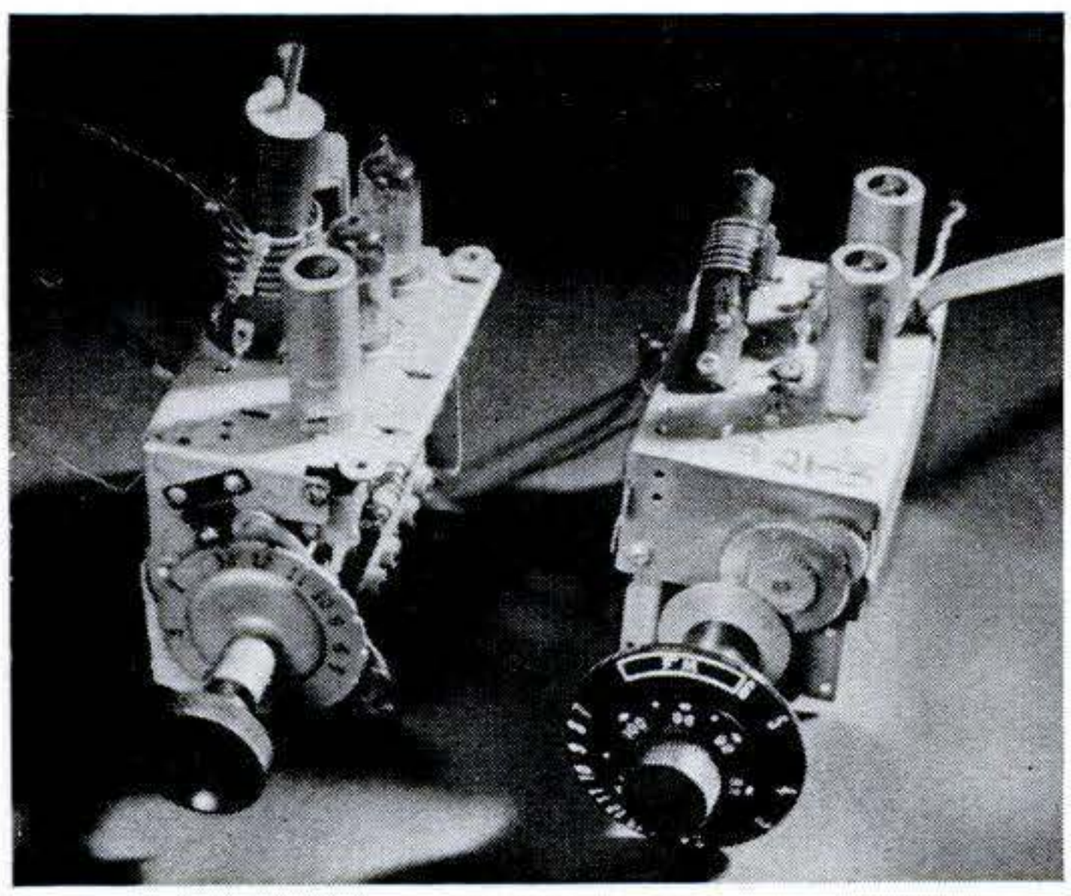
Only visible change in TV set to which the new DuMont tuner has been added is replacement of dial above by one at right. Its outer band is used for TV and its inner band for FM.

New Tuner Adds Radio To TV

You can put in this tuner and hear FM broadcasts on a video receiver. And pictures will come in better, too.

By Robert Gorman

A MILLION or more of the TV receivers now in American homes can be converted so that they can be also used as FM radio receivers. The original tuners in many of these sets are becoming worn. They can be replaced with newly available "front ends" that both bring in FM broadcasts and improve the reception of TV pictures.



Switch-type tuner (left) used in many TV sets and the new Inputuner (right) are both physically and electrically interchangeable.

These units, the latest in the line of DuMont Inputuners, can be substituted for the switch-type tuners in most of the RCA 630-TS circuits found in about 20 different makes of sets. They can also be put into many other TV receivers that have separate intermediate-frequency circuits for pictures and sound. But they aren't recommended for sets that have "single channel," sometimes called "intercarrier," sound systems.

How about your set? To see whether the new tuner could be used in your set, first compare its dimensions (given on the next page) with those of your present tuner. Then consult the manufacturer's service manual. If your receiver has an intercarrier sound system, you will not find more than one sound IF stage on the diagram, but if it is a dual-channel receiver the diagram will show two, three, or more tubes labeled "sound" or "audio" IF.

Another important item is the sound IF frequency. Various ones have been used in different sets. Replacement Inputuners are made for two of the most common IF sound frequencies: 21.25 and 21.75 mc.

How it's installed. Installation of a new tuner is not difficult. Remove the chassis and loosen the screws that hold the old tuner in place. Snip off the flat ribbon lead-in wire that runs to the tuner from the antenna-input terminals.

Turn the chassis over and trace, with the

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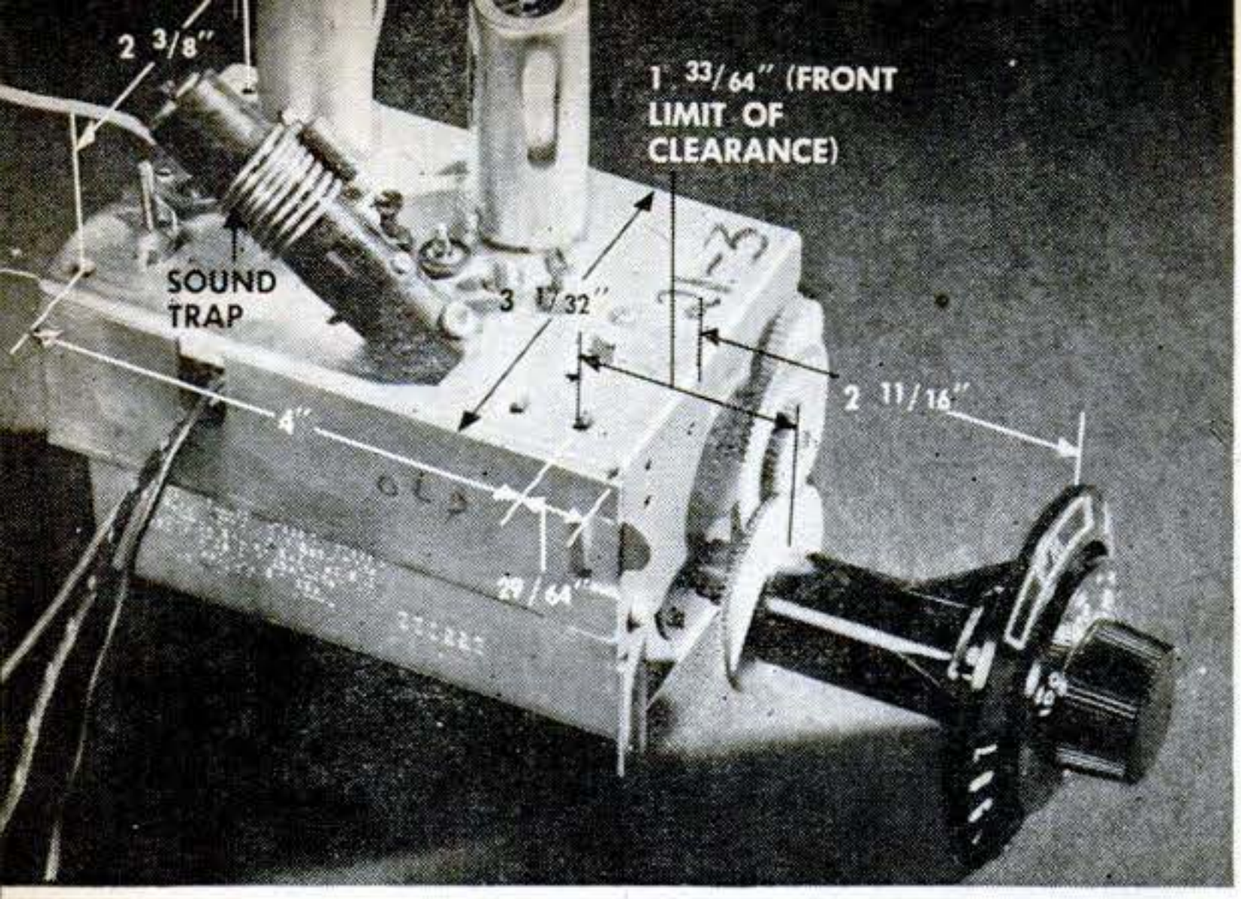


Check these dimensions against corresponding ones on your present set and tuner. Some models of the new unit do not have sound take-off trap.

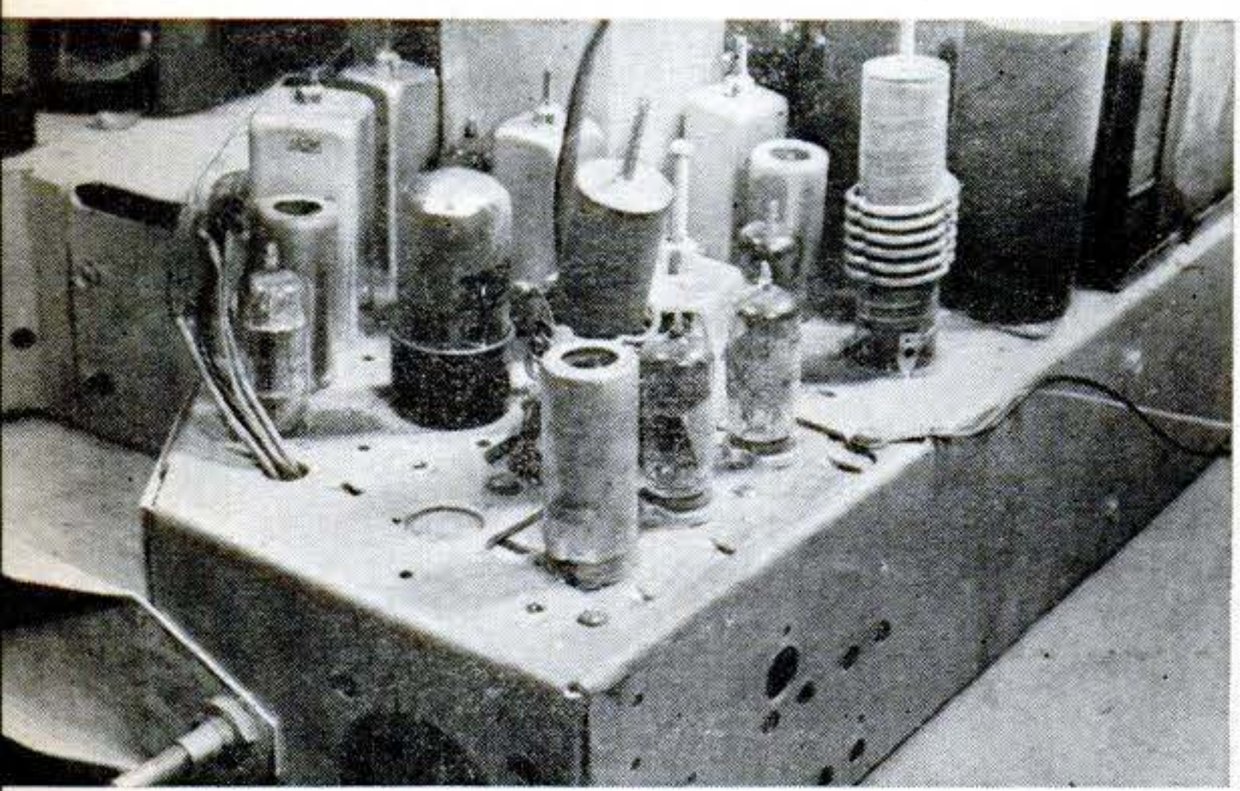
help of your diagram, the five leads that connect the tuner to the other circuits. Note where each wire ends and then unsolder the lead. If you can't reach it with a soldering iron, snip the lead, leaving an inch or so of wire. You'll then be able to splice a new wire to the old one.

One lead goes to B-plus, another feeds the 6.3-volt heaters, and a third connects to the grid of the first sound IF amplifier. A bare wire coming through the back of the tuner goes to the grid of the first video IF tube. It must be kept short. A fifth wire is supposed to feed into the AGC (automatic gain control) circuit. Some sets, including the original versions of the 630, do not have AGC. The procedure, however, is the same; just substitute this lead for the fifth connection of the original tuner. In the 630 it goes to the diode plates of the first audio amplifier, a 6AT6.

When you've restored the twin-lead connections to the antenna terminals, you are ready to tune in your new TV-FM combination. Replace and connect the picture tube and adjust the ion-trap magnet for the brightest raster (scanning lines at an unoccupied channel). Make sure that there are no shadows at the corners of the raster.

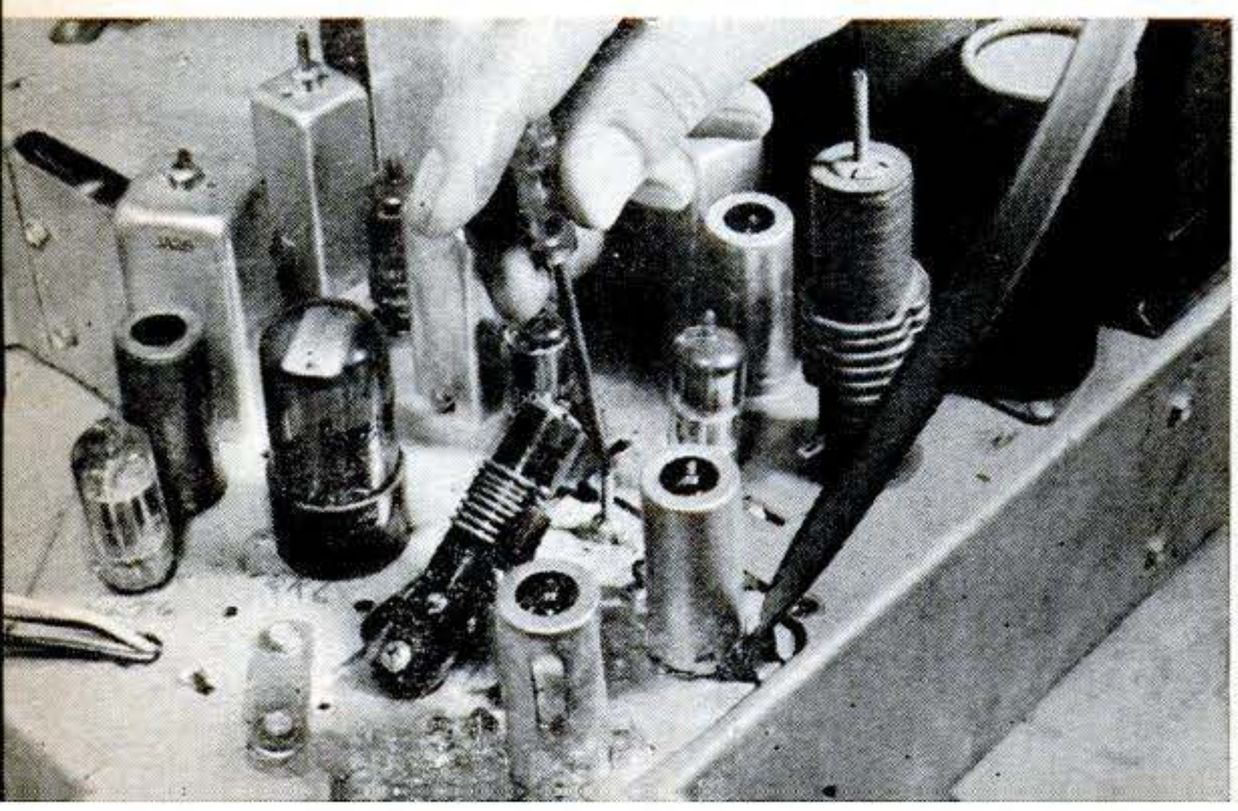
Final adjustments. You should get good picture and sound immediately, but a couple of touch-up adjustments may sharpen them both. The alignment points are the grid-coil adjustment (see photo) and the slug in the sound trap. Undoubtedly the best way is to align them with a signal generator and a vacuum-tube voltmeter, but it should be possible to peak them pretty well by turning the adjustment screws and looking and listening very carefully. Don't touch any of the other slugs.

And don't be satisfied with pictures that are only just as good as before. This tuner has about twice the gain—especially on the high channels—of the models it replaces. It also should do a better job of rejecting unwanted signals. END

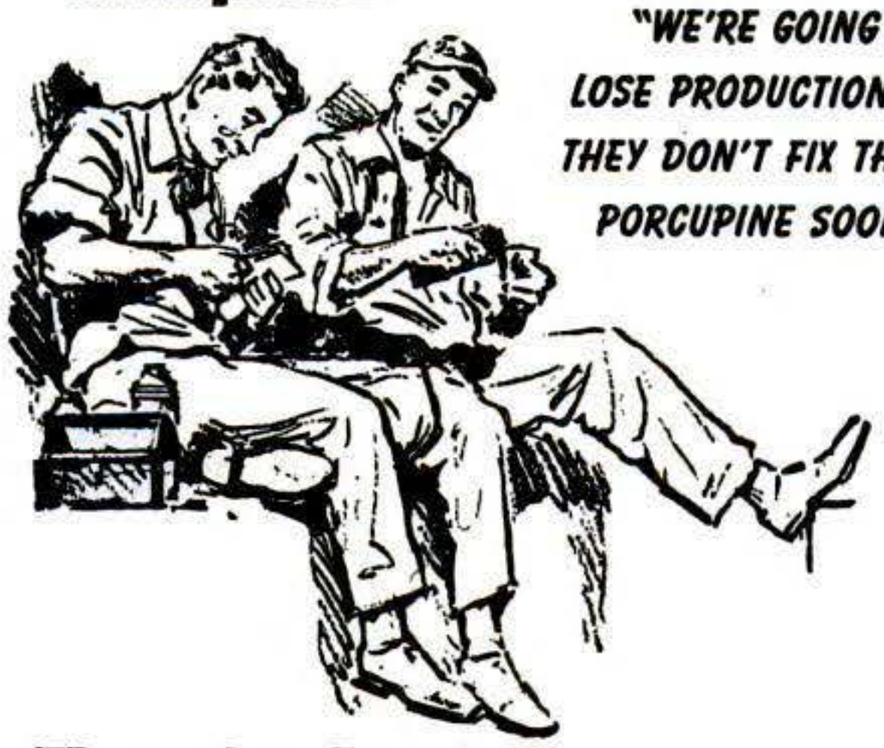


Tuner sub-chassis is bolted to cut-out in main chassis. Before removing unit, identify wires coming from it with aid of circuit diagram.

Slight adjustment must be made to peak the video and sound. Adjustment points are grid coil, shown, and movable slug in sound trap.



Shoptalk



What are they talking about? Where do they work? Answer below.

They're steel workers. A porcupine is a revolving cylindrical rack for cooling and inspecting galvanized sheet steel.

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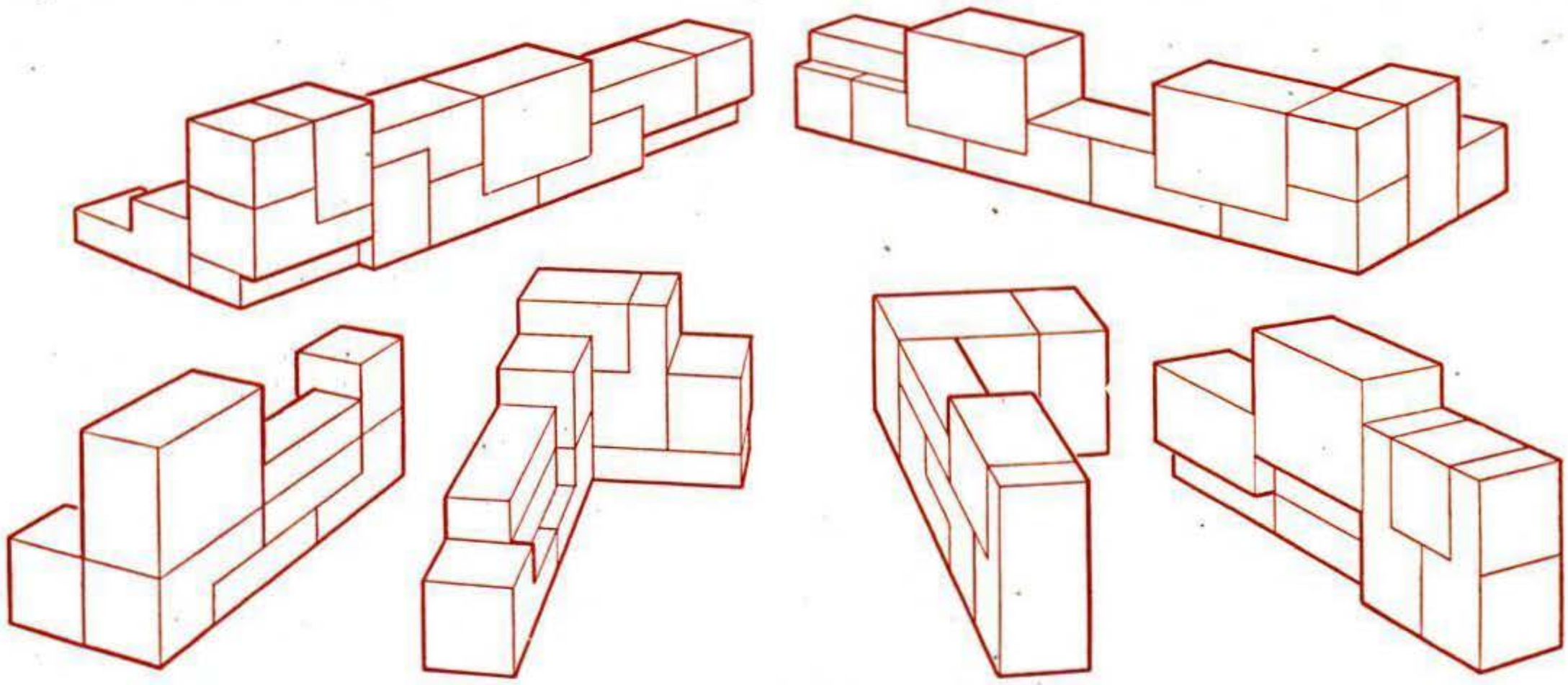
Storage Units You Can Move

They're easier to rearrange than furniture—and anyone can build them.

By Roland Cueva

BUILD your shelves for magazines, books, records, and knickknacks this way and you'll have solved one storage problem for life. If your wife rearranges the furniture, shelves can be made higher, lower, shorter, or longer by simply stacking them up differently. No landlord will object to such movable walls. And when you move, you can take them with you.

You can turn out a complete set with only hand tools if you make the full units and



New arrangements are almost unlimited since units will fit together in many different ways.

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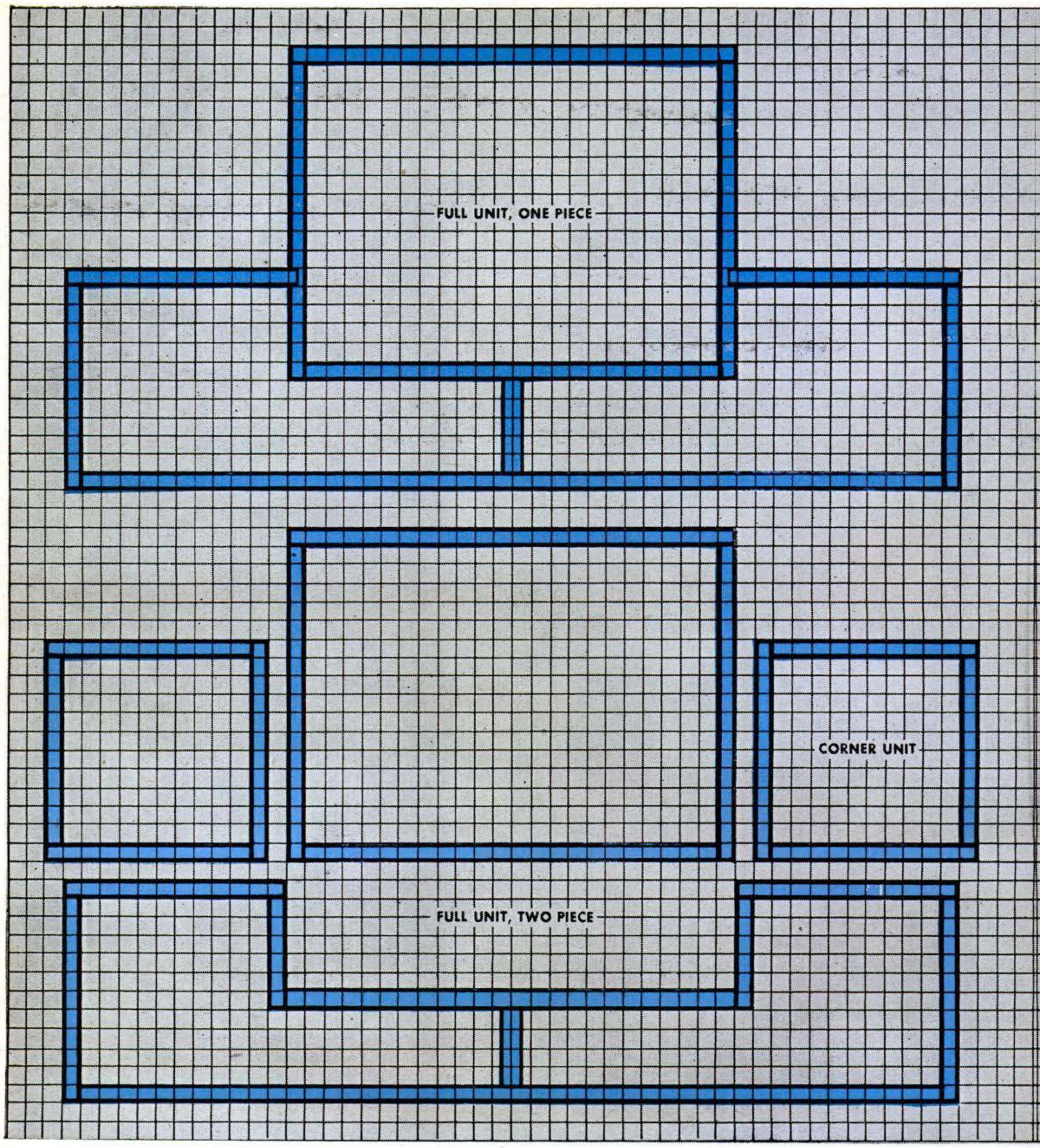

the half units as two-piece jobs. If you build them as single pieces, you should use dadoes, and this will generally require a circular saw. Otherwise, all joints are simple butt joints nailed and glued.

Build as many or as few units as you need. You can always add new ones because they are extremely simple and inexpensive to make. In the set shown in the photo on the preceding page there are two full units, one half unit, two corner, and four base units. Materials for these nine units cost less than $10.

All the units fit together in several different ways because of their stepped design and because of standardized dimensions. The outside dimensions are either 6″, 12″, 18″, 24″, or 48″.

With the exception of the base units, all of them are cut from 1″ by 12″ planks. The base units, made from one-by-tens, are the only units that have backs, which can be

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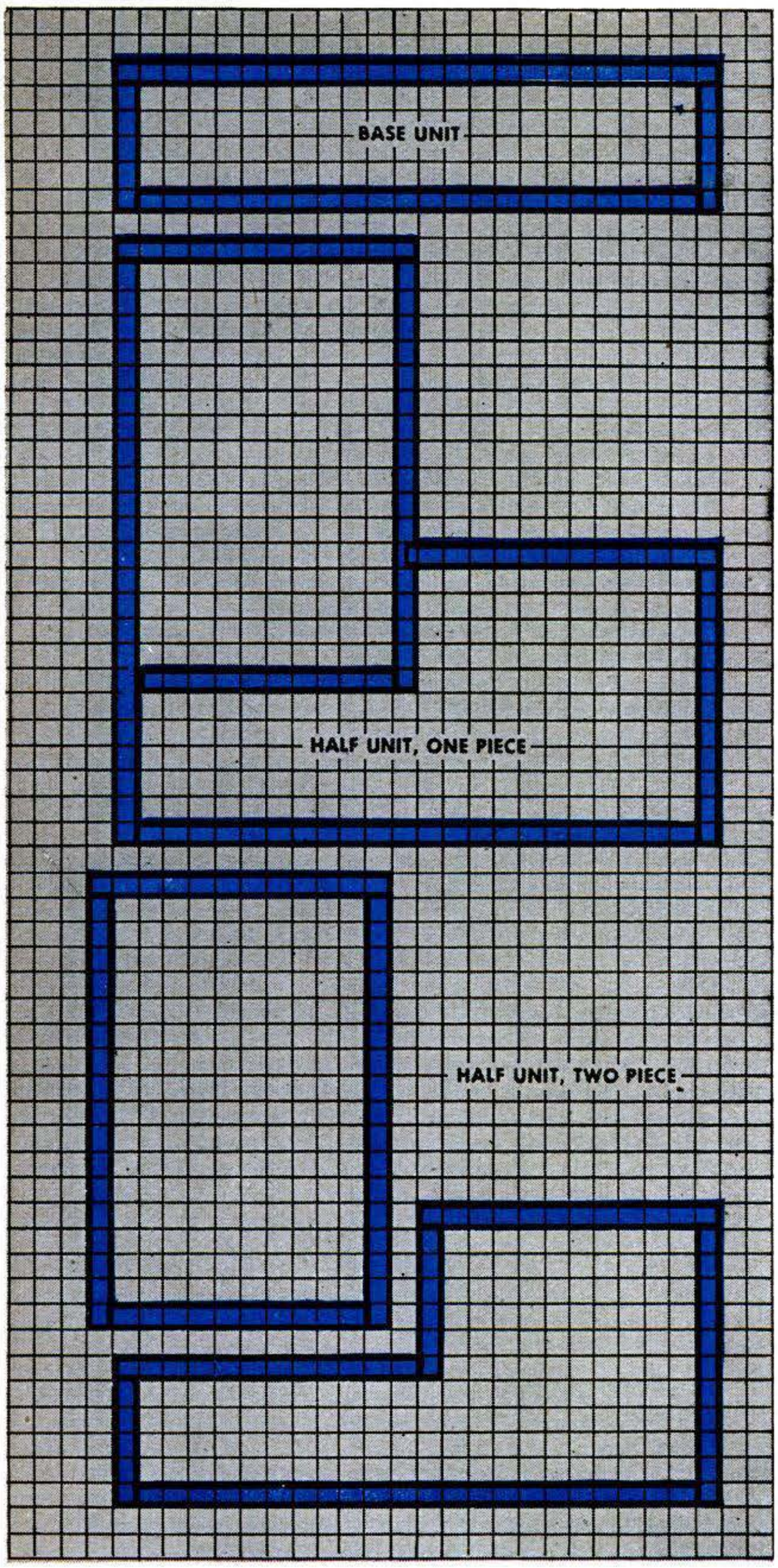
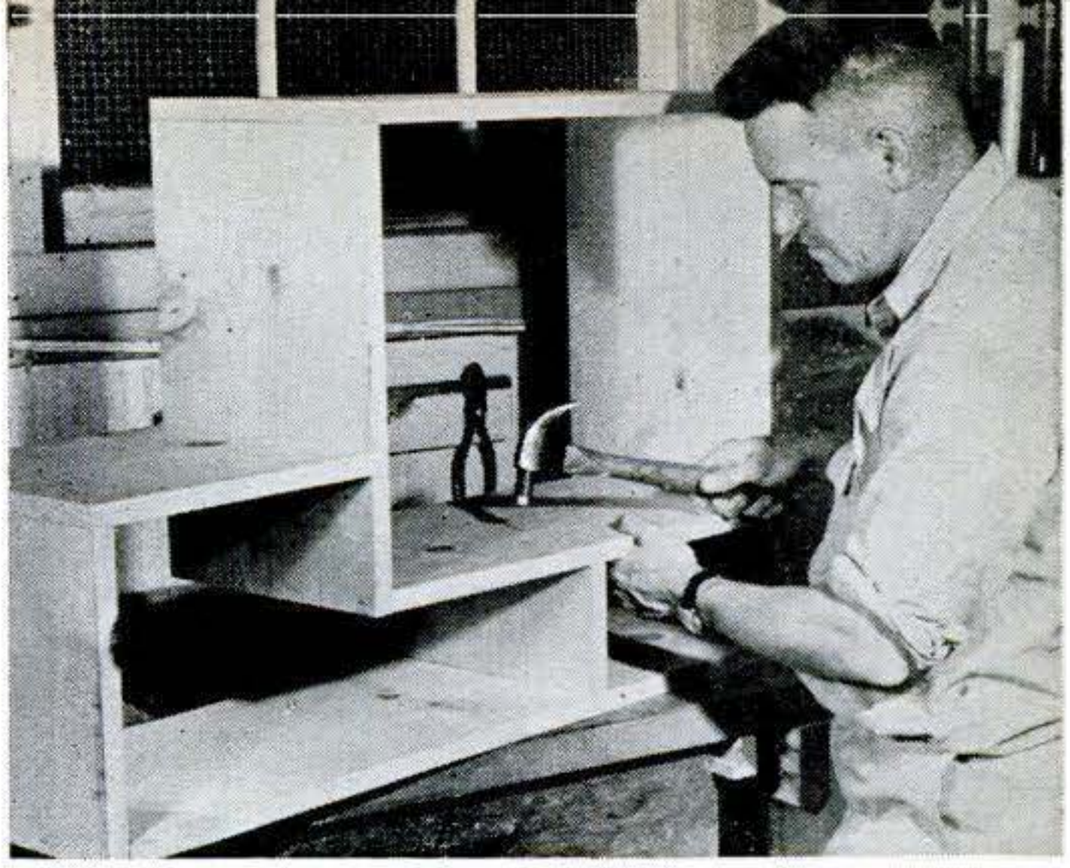
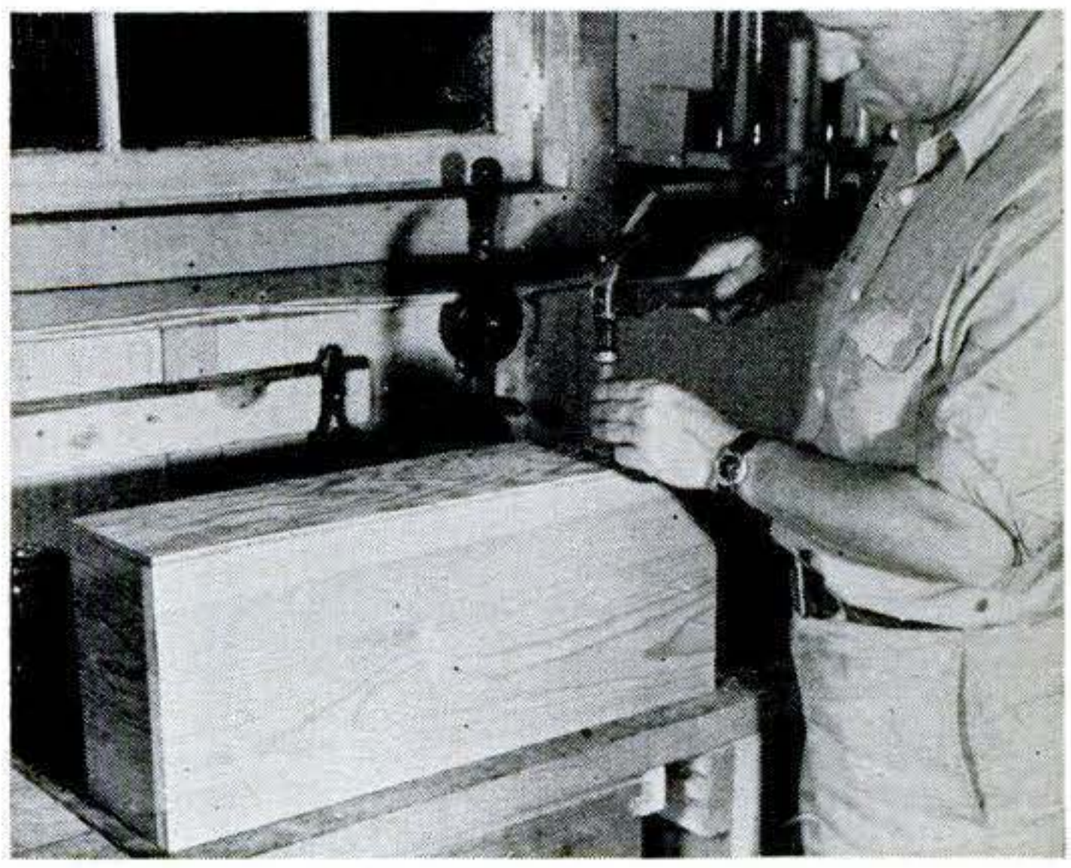


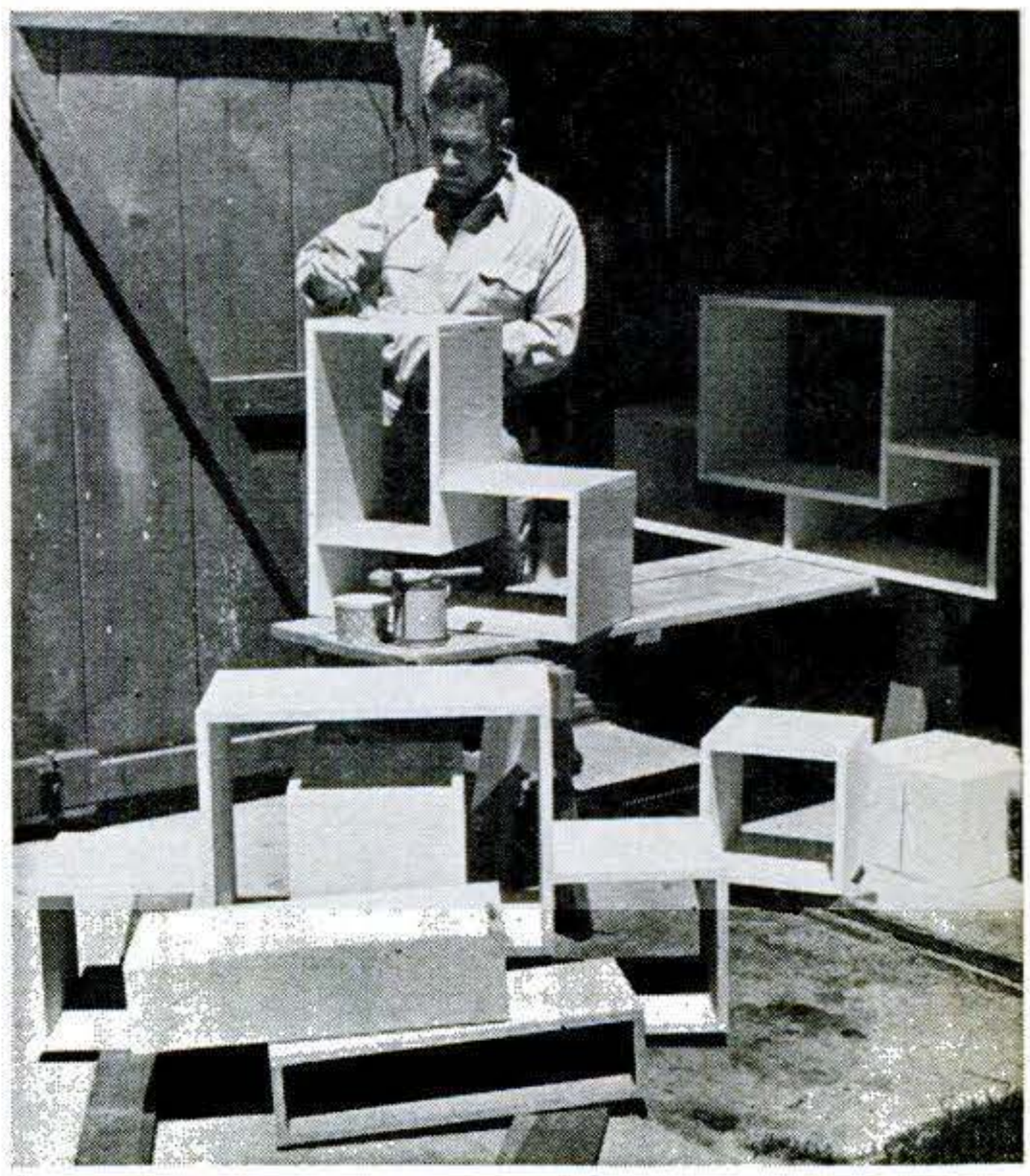


Top pieces of full unit's outer section fit in dadoes of center section. In photo above, bottom divider piece is being nailed in.



Plywood back is being attached to base unit with small wire nails. This unit—2" narrower than others—is only one with a back.

Completed units are shown below. Nail heads were countersunk and filled over with composition wood. These units were enameled.



cut from ¼" plywood. The bases—narrower than the other units—are designed to give you toe space. However, with their open sides out, the bases can be used on top of the other units for more storage room.

Second-grade pine (No. 2 common) is all right for the units if you take care to fill the cracks, sand well, and apply a good undercoater before final painting. Clear pine is best, of course, but it costs about double the No. 2 grade. END

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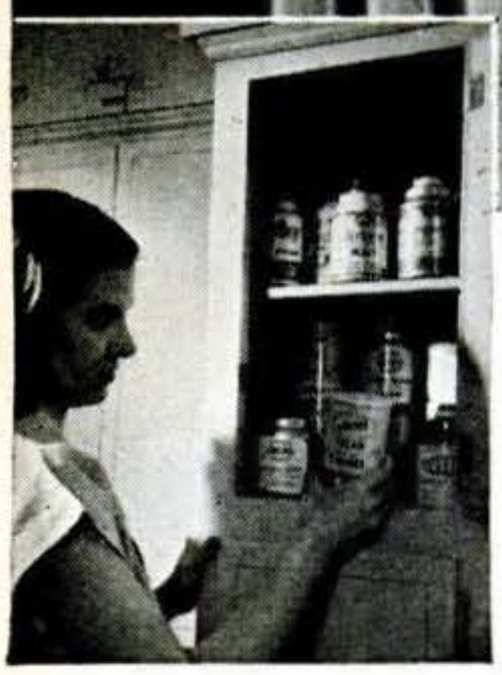
Bomb It with Paint



You can store spray paints in a kitchen cabinet. They take up little space and aren't messy and smelly like partly used cans of ordinary paints. But don't put them where they'll get too hot.

Dress up the radiators in your home with a spray paint. Painting radiators with a brush is a messy, tedious job. But with a spray pack you can do the job cleanly and quickly. Place cardboard behind the radiator to protect the wall, cover the floor with newspaper, and you're ready to start spraying. For wrought-iron railings, metal lawn furniture, and wire fences and gates, aluminum spray does a good job.

Stop oxidation of your copper screens by coating them with clear plastic spray. Oxidation of copper screens often causes ugly, streaky stains on the wooden siding of a house. First clean the mesh by dusting and washing. Stack up three or four screens and spray them. Keep the spray moving at all angles to cover all surfaces of the wire. Then turn the screens around and spray them from the other side.

Save the shine on brass fittings by coating them with transparent plastic spray two or three times a year. This spray also is excellent for tools and ferrous-metal surfaces to prevent rust. Use it on ice-skate blades and sled runners when you put them away for the summer. Use it, too, to preserve handles of tennis rackets, golf clubs, fishing rods, and other pieces of sporting equipment.

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Now you can turn out professional spray-paint jobs—and without laying out a lot of money for a spraying outfit.

By Bernard Gladstone

PS PHOTOS BY W. W. MORRIS

PUSH-BUTTON painting is easy. It's fast and neat, too, and when you're finished there are no brushes to be cleaned.

The new paint bombs now available (PS, Dec. '50, p. 102) work best on small objects and things that have many sides or curved surfaces—such as wire grilles, toys, machinery, lamp bases, tools, radiators, and wicker furniture.

You may find it difficult to get an even, glossy coating on a large, flat surface because the nozzles of the cans are not adjustable. But if you're careful, you can paint almost anything with spray packs.

Heed These Tips

Always shake the can before starting and every few minutes while using it. Shaking activates an agitator in the can and keeps the paint from settling.

Do your spraying in a room where the temperature is at least 70° F.

Hold the can at the right distance from the work—10 to 14 inches, depending on the maker's instructions. Holding it closer will cause the paint to pile up and run. Holding it farther away will give you an uneven finish.

Hold the can at the same distance from the work all of the time. Swinging the can in an arc will bring the nozzle closer to the work at the center of the arc than at the ends.

Always start spraying beyond the edge of the work, and carry the can beyond the opposite edge before stopping. This will prevent one spot—especially the edges—from getting too much paint.

For an extreme change of color, use two coats. Let the first coat dry 6 to 8 hours.

Don't stop moving the can while you are spraying.

Don't spray in drafts or outdoors unless the air is still. The spray is extremely fine and the slightest breeze will blow it.

Don't use the can around open flame.

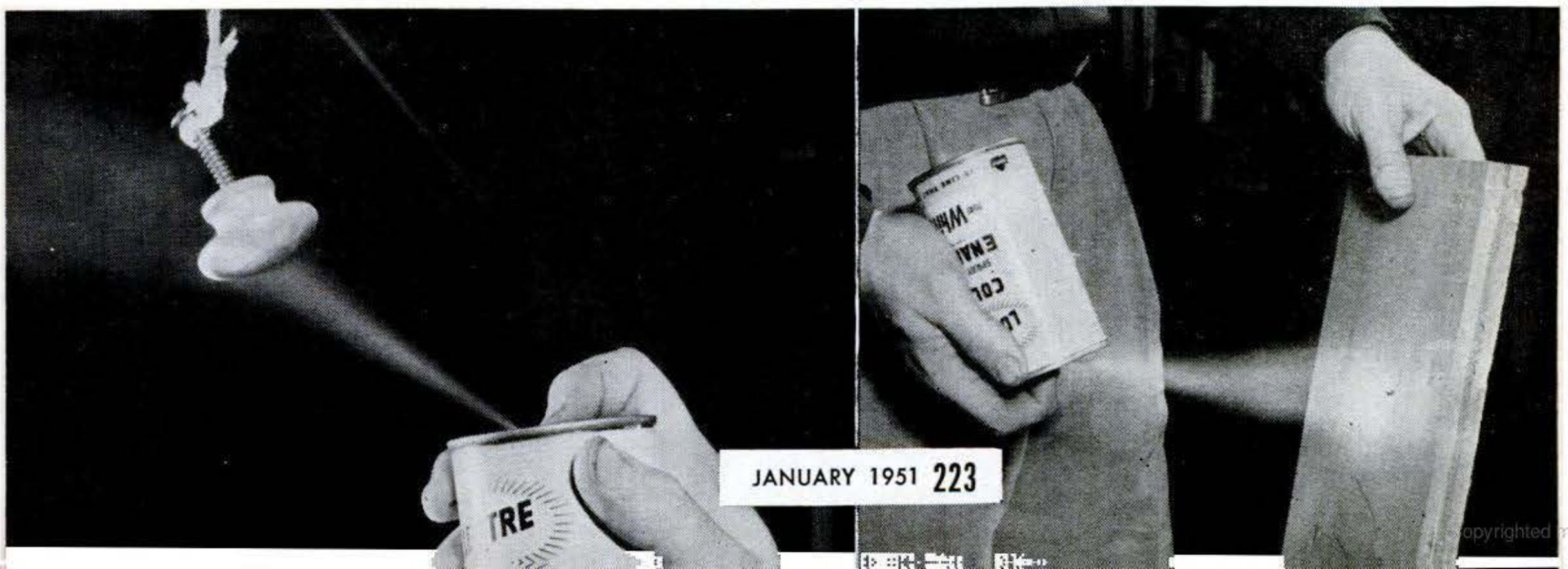
Don't throw used containers in a fire. They may explode.

Don't puncture a container. It may explode and you will get a face full of paint and perhaps pieces of the can. END

Mask off parts of your work when doing a two-color job. Here the drawer pulls are being sprayed a darker color than the drawer fronts. Masking tape and newspaper keeps the darker color off drawer fronts. Let the paint dry completely before pulling off the tape.

Spin it and spray. By using this simple trick you can quickly and evenly cover all sides of a small object. Tie one end of a string to an overhead beam and the other end to the object. Wind up the string 20 or 30 times and let it go. As the string unwinds, it spins the work while you spray it. This method is easier and neater than holding the object in your hand and twisting and turning it as you spray.

Clear the nozzle after you've finished spraying. Turn the can upside down and give it several short blasts. This clears the fine nozzle opening of the last few drops of paint. If you don't do this, paint will harden in the nozzle and you may find your spray pack useless the next time you try to use it. If the can you have is normally used upside down, turn it right side up to clear the nozzle.



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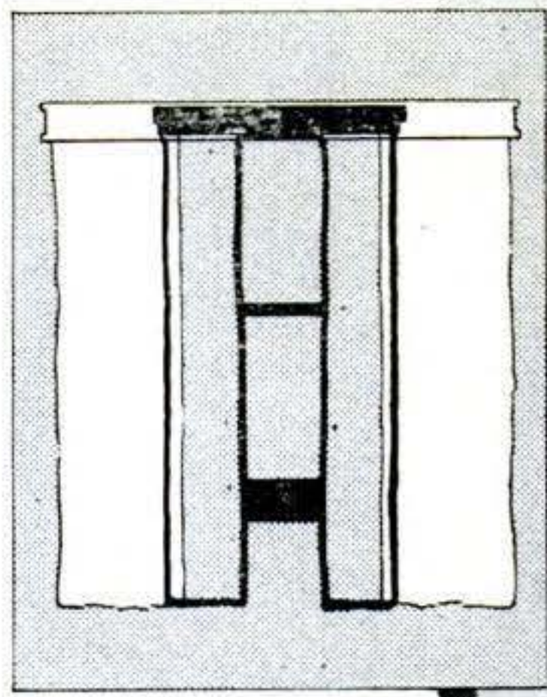
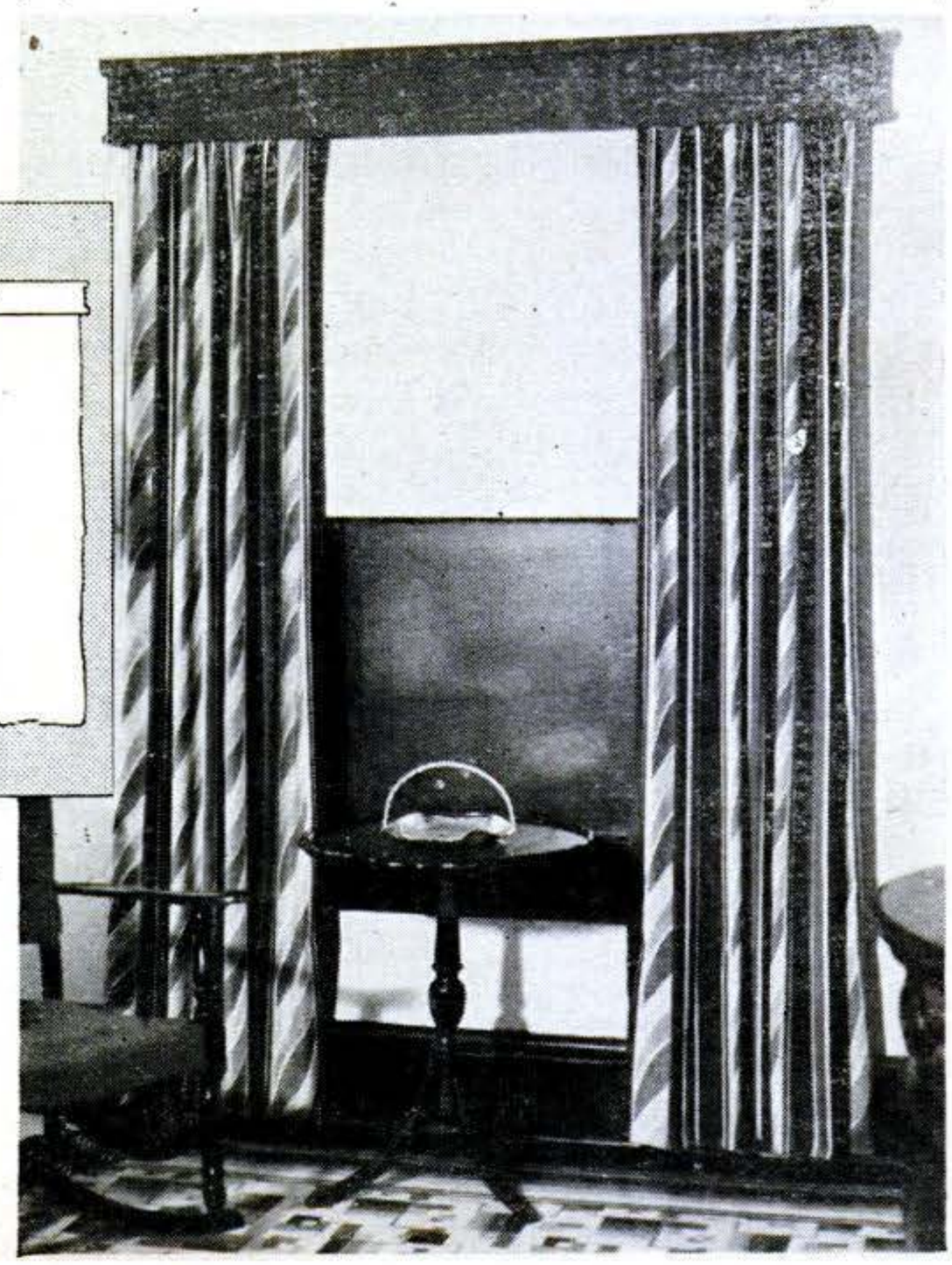
No squawks from the landlord with valances like this. When you take them down, they leave no visible trace and can be used elsewhere.

Invisibly Held Valance Modernizes Old Windows



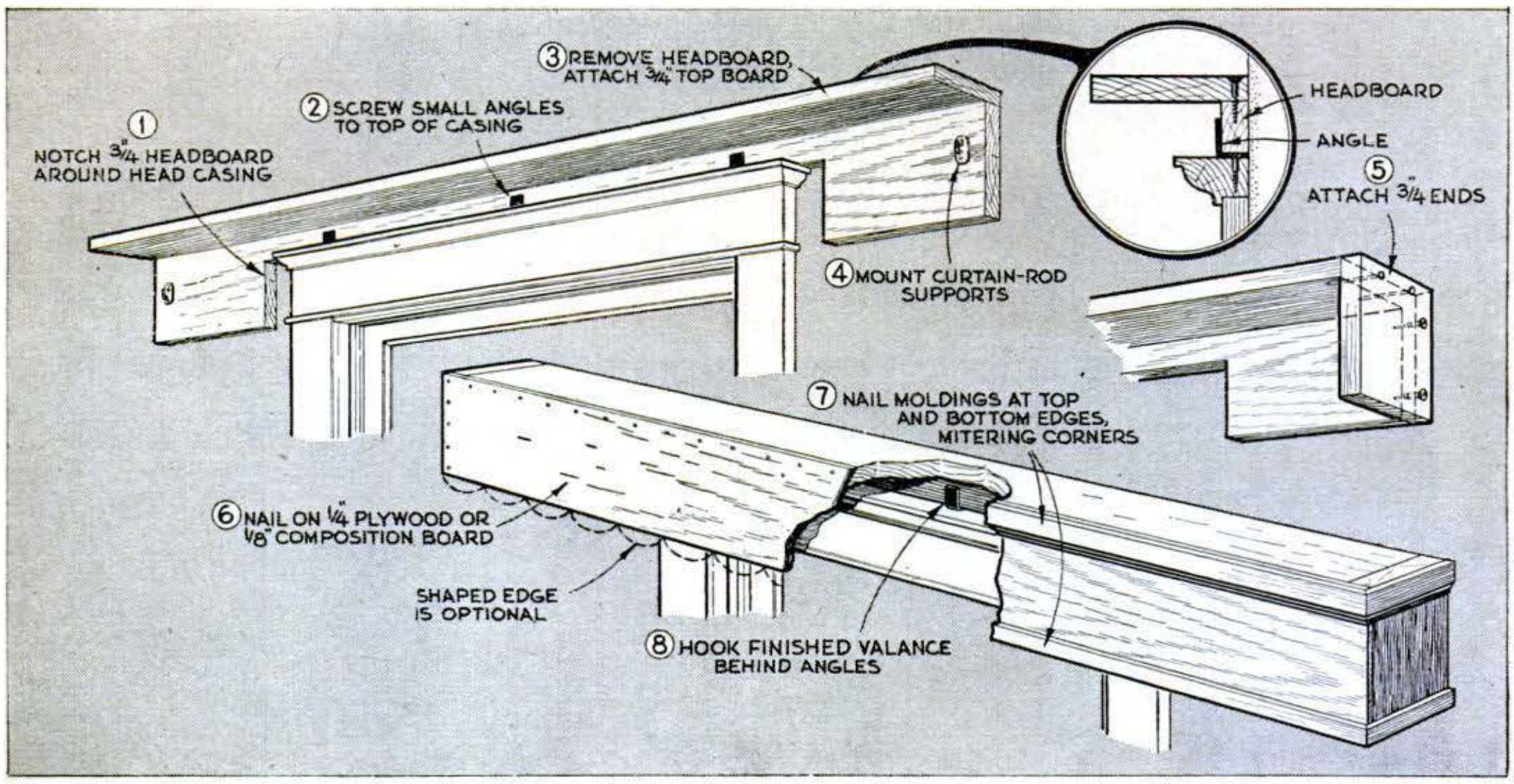


VALANCES can give you a modern wide-window effect even though your home has narrow windows. Simple to make with hand tools, the valance shown spreads drapes to twice the width of the window frame. It can be removed instantly, leaving no unsightly holes in walls or casing. Should you move, it can be made to fit other windows that vary as much as a foot in width from the one it was built for.

Make the valance 5″ deep, 6″ high, and about twice as long as the window is wide. This gives ample room for curtain rods or drapery hangers. Instead of the simple modern style shown, you can scallop or otherwise shape the face board, omitting one or both lines of molding.

It's best to fasten the sides and top to the back board with screws rather than nails. This makes it easy to disassemble the unit for replacing rods or hangers or enlarging the notch to fit a bigger window. Where nails are used, sink and putty over them and sand well before finishing.

Two or three small angle brackets are screwed on top of the window casing, where they don't show. The valance is simply hooked behind these and can be lifted off at any time.—*Michael Ligocki, Gary, Ind.*



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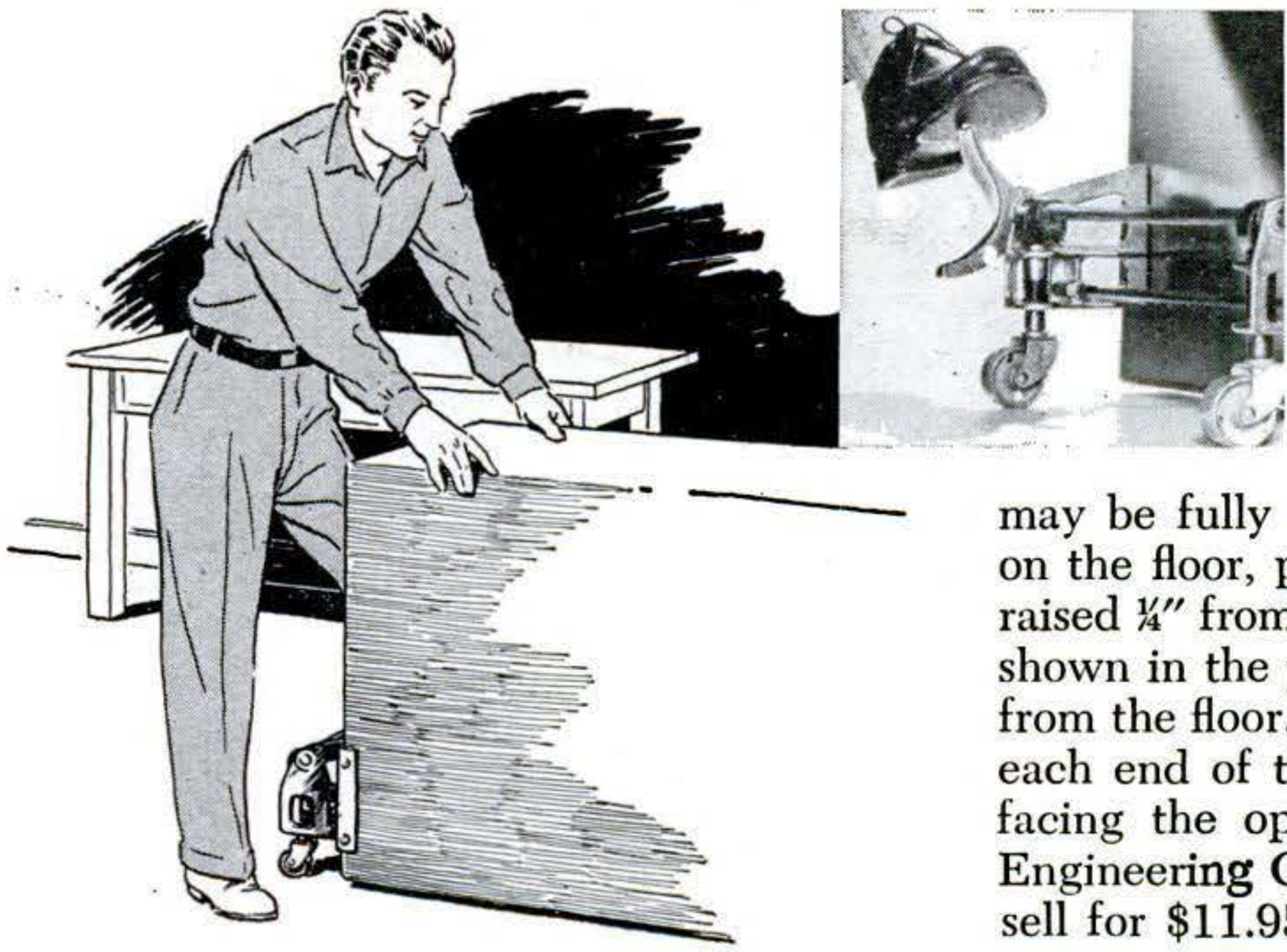
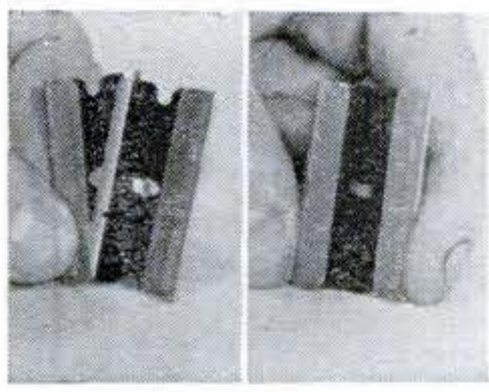
New Bench Casters Raised or Lowered by Foot Power



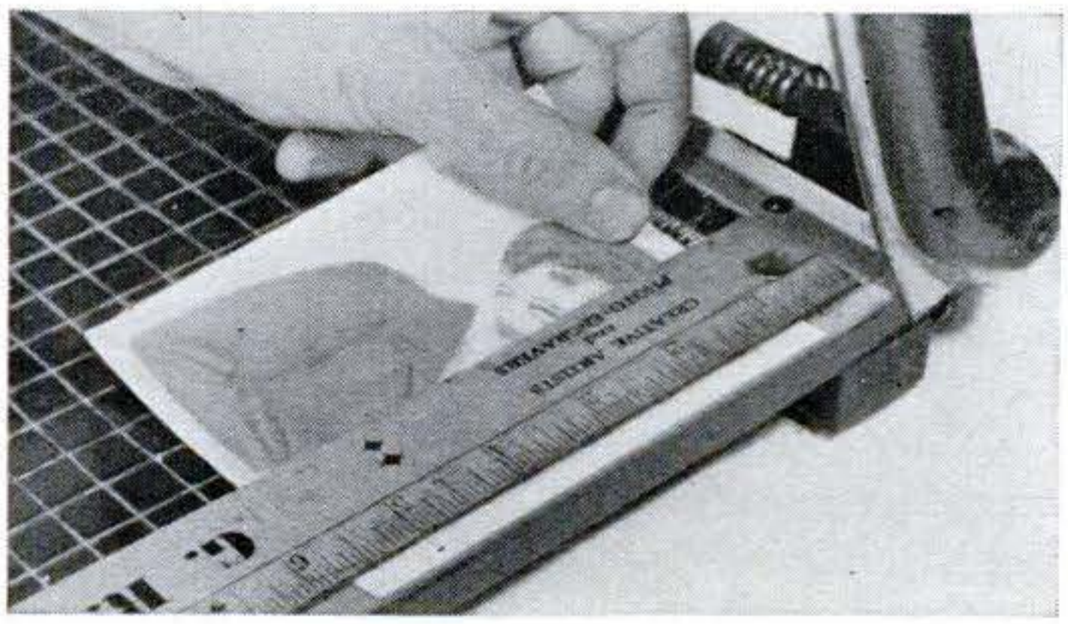
Press, it's locked. Press again, it's released. Easy foot action turns the three-pronged lever to raise or lower casters on this assembly. Designed for use on benches or machine stands, it has cam stops that lock in three positions. The casters may be fully retracted with the bench legs on the floor, partially lowered with the legs raised ¼″ from the floor, or fully lowered (as shown in the photo) with the legs raised ½″ from the floor. One assembly is bolted inside each end of the bench with the foot levers facing the operator. Made by the Magna Engineering Corp., San Francisco, the units sell for $11.95.

Storing Razor Blades Safely

SAFETY-RAZOR blades are useful for many cutting jobs around the house and shop but are dangerous to keep about with the blade uncovered. The single-edged type, fitted together as shown, may safely be kept in a drawer or carried in a pocket. Just press two blades together with the cutting edge of each inserted under the metal back strip of the other.—*John J. Rea, Urbana, Ill.*



Straight Edge Makes Trimming Easy



A RULER thumbtacked to your cutting board will help you cut even borders on contacts and enlargements. Press in the tacks, then pry up the ruler just enough to allow you to slip prints underneath. When trimming, align the masked edge of the photo with the ruler. You can determine the border width by adjusting the distance between the ruler edge and the cutting edge.

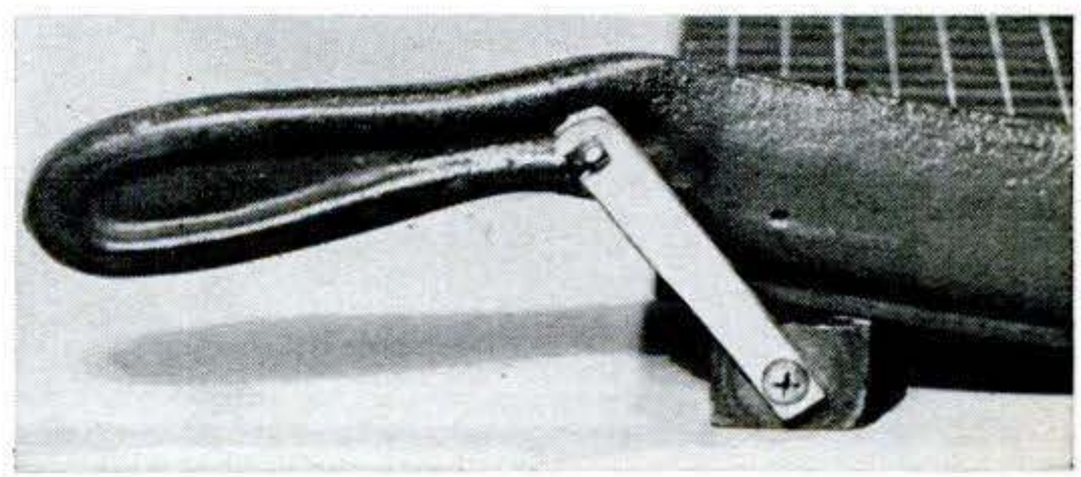
Flashlight Makes Darning Light

I HAVE found that a flashlight serves more efficiently for darning than a darning egg. When the light is on, it shines through, illuminating the work and lessening eye strain.—*H. Leeper, Canton, Ohio.*

Catch Holds Cutter Blade Down

IF YOUR print trimmer has a spring-action knife, making the raised blade a hazard when the trimmer is idle, you can easily add a safety catch to hold the blade down.

You can make one of a bit of strip metal, but it is easier to use a long mending plate or one leg of a flat angle plate that is already drilled with a hole for screwing the catch to the trimmer base. File a notch in the opposite end. Drill a hole in the trimmer handle to take a short bolt and retaining screw. Then screw the catch to the base of the trimmer, draw down the handle, and slip the notched end over the protruding bolt.—*Roland Wolfe, Palo Alto, Calif.*



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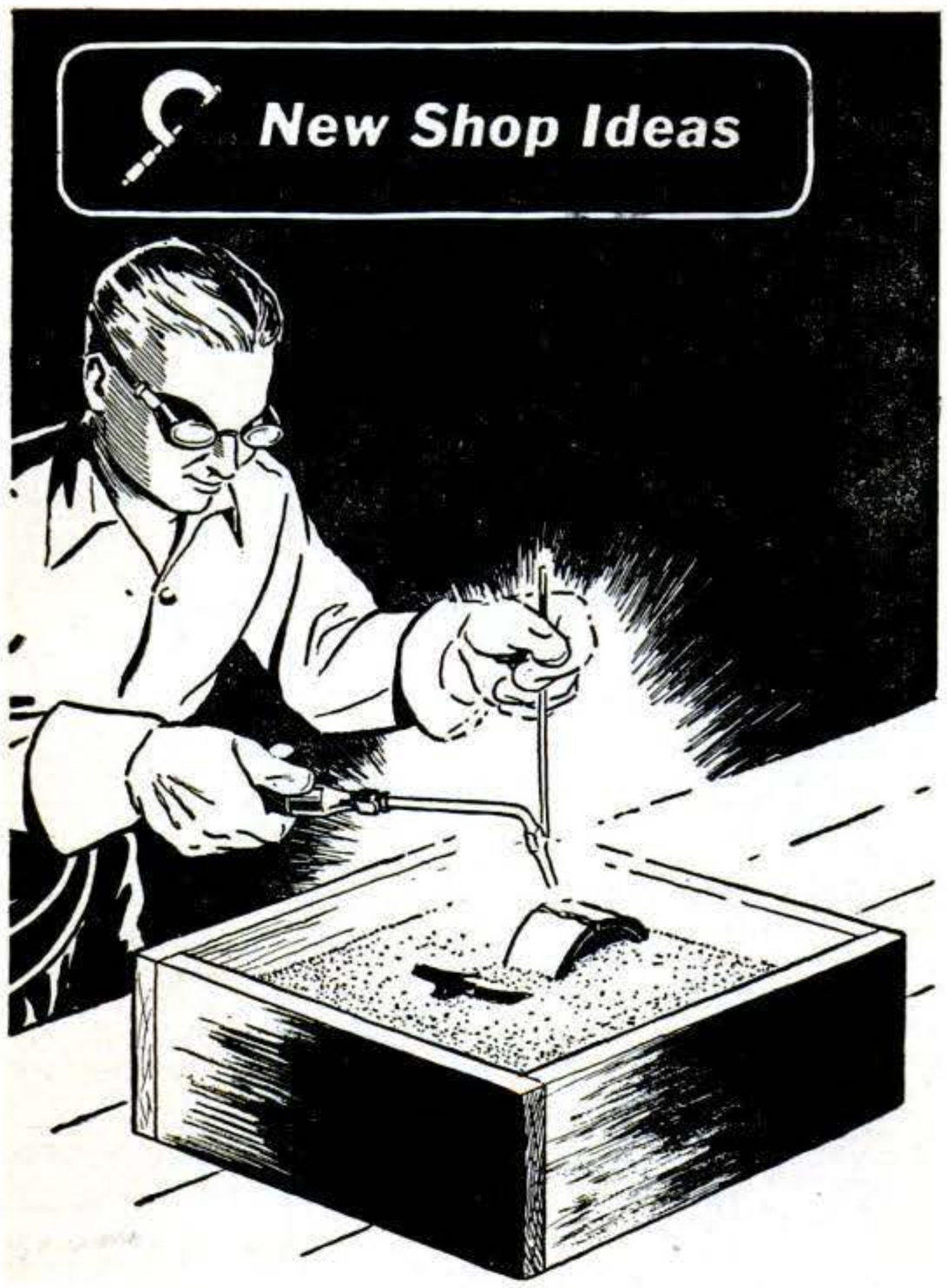
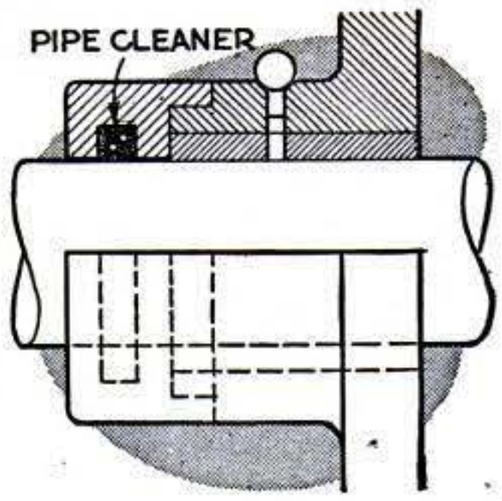


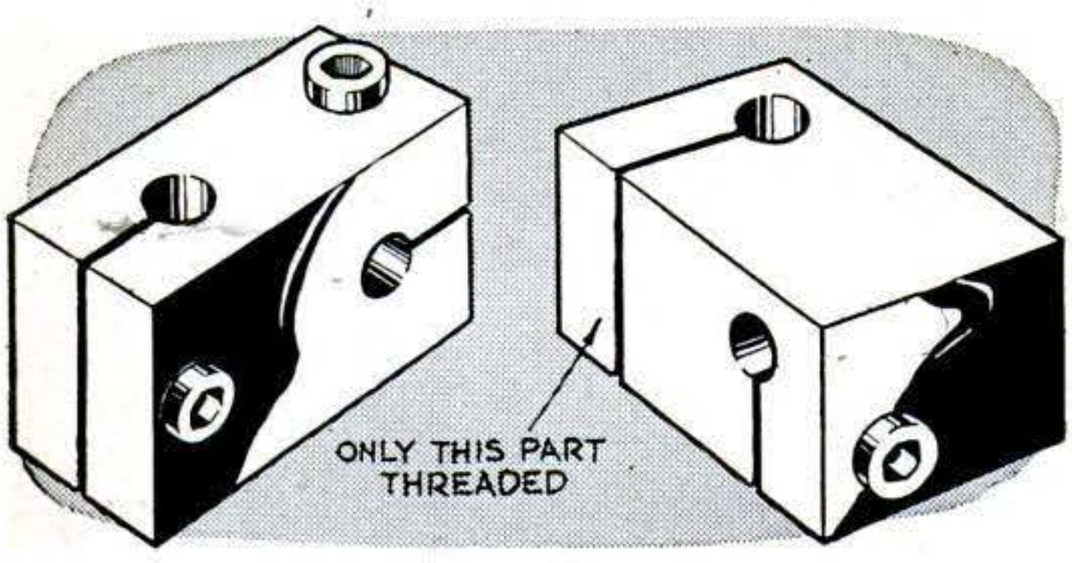
Pipe Cleaner Seals Out Dust. An ordinary pipe cleaner makes a good substitute for a felt dust seal around a shaft. Wind the cleaner around the shaft and cut it to length. It will spring out with enough tension to hold itself in the groove. If two or more cleaners are needed, stagger the butted joints. The short fibers, perpendicular to the shaft surface, form an effective seal.—*Edward P. Meyer, Champaign, Ill.*

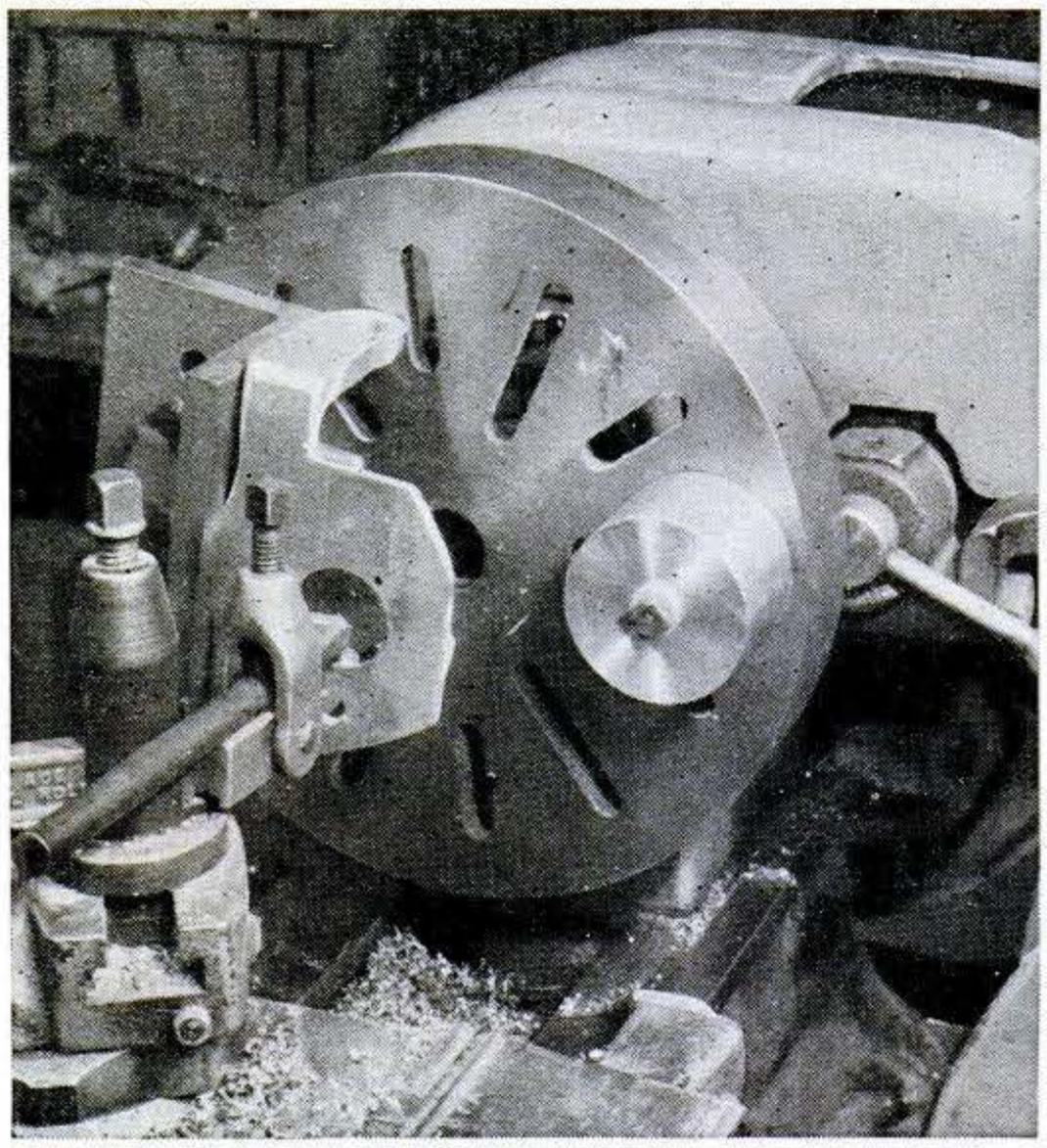


Sand Holds Welding Job. Parts that won't lie flat, or because of the way they are broken won't support themselves, can be held in position for welding in a sandbox. For small jobs, a box 6″ deep by 18″ square will serve. Put in 5″ of thoroughly dry, fine sand. Wet sand may spatter and should be avoided.

Work the parts down into the sand with the break areas in contact. A tack weld will hold them together; then you can remove them from the box to finish welding in any convenient position.

One Bolt Clamps Two Ways. Split blocks for clamping two rods at right angles or for mounting instruments on uprights are usually made as at the left below. By slotting them from one face and one edge as at right, you can use a single long bolt to pinch both holes. This leaves one hand free for positioning parts, while the other tightens the clamp. —*Frank M. Butrick, Jr., Alma, Mich.*





Lathe Weights Cast in Cans. The vibration set up by heavy, off-center work wears lathe bearings and makes accuracy impossible. Such jobs should be mounted with counterweights. Those shown below are cheaply and easily made by pouring lead to a number of different depths in tin cans of various sizes.

When cold, the castings are removed, bored, mounted on a mandrel, and turned down to the desired weights. It's well to cast a few extra and leave them on hand to turn down as needed. Mount weights with square-head bolts your toolpost wrench fits.—*W. Thomas, Buffalo.*

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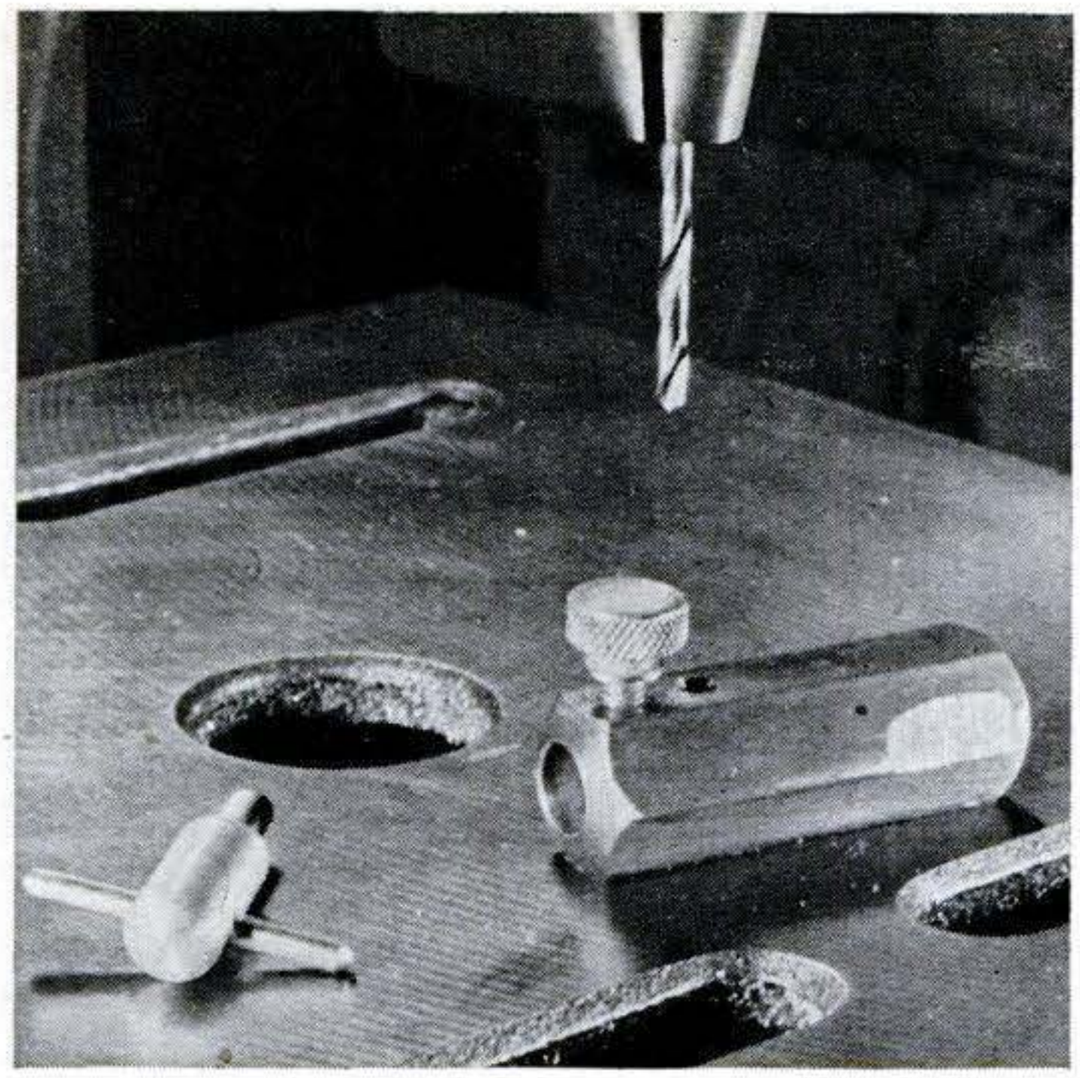
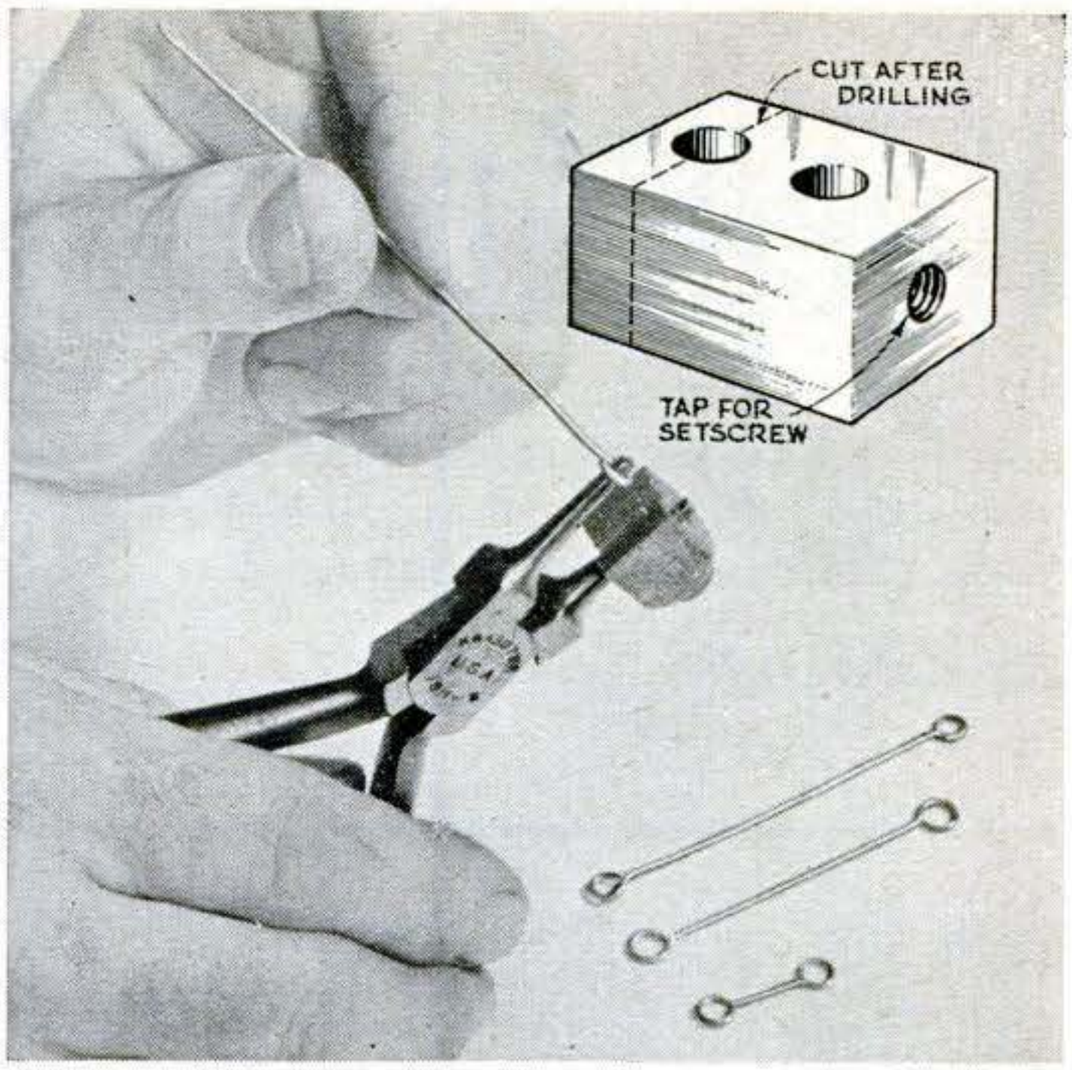


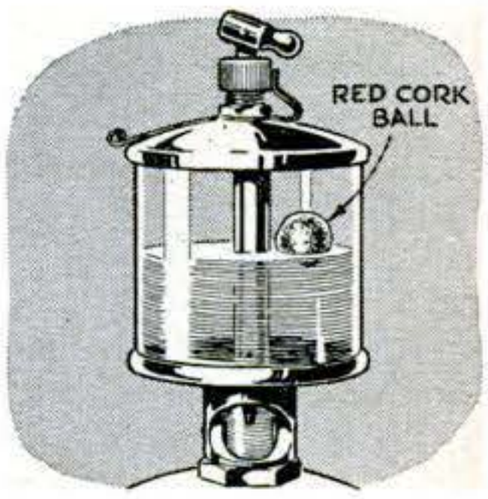
Drill Jig of Hex Stock. A jig's the thing for drilling cross holes accurately in a number of pieces of round work. But a jig made of flat or square stock calls for accurate layout and machining, scarcely warranted for short runs. Use hex stock, which is easily centered in the three-jaw chuck for drilling the main hole in which the work goes. The only critical job is centering the cross-drilled hole on one flat. Tap a second hole for a clamp screw to lock the work.—*Floyd McGuckin, Ridgewood, N. J.*



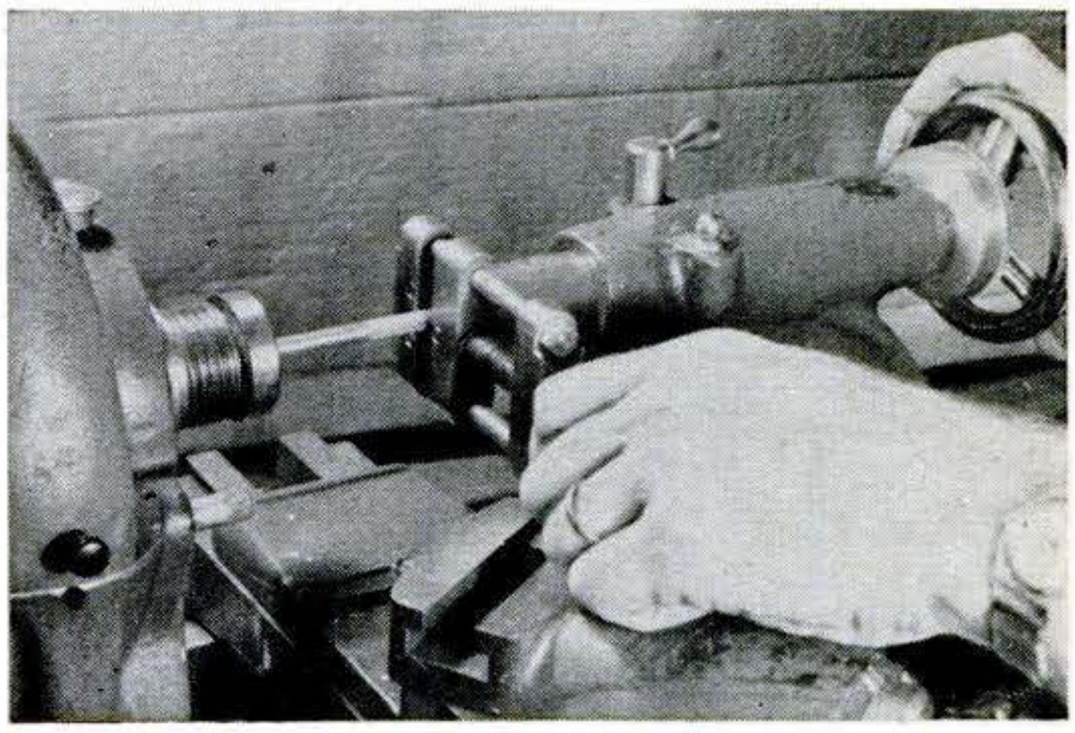
Forming Perfect Loops. If you often have to form neat looped ends on wire, it will pay you to make the block above for use with round-nose pliers. It shapes perfect loops easily and quickly. Drill two holes through a small block of steel as shown in the drawing. If you have a taper reamer to match the taper of the pliers, ream them both before cutting the block. If not, cut the block first and shape the holes with a rattail file. Tap the end for a setscrew to hold the block on.—*John J. McGuckin, Ridgewood, N. J.*

Speed Wrench Tightens Chuck. A real timesaver when you have to chuck many pieces of different diameters is a wrench made from a cheap brace or a speed handle. Simply saw off the end or socket and file or mill the tip to fit the wrench opening in the chuck screws. —*Walter E. Burton, Akron, Ohio.*

Oil-Level Telltale. A machinist friend gave me this tip on how to tell the amount of oil in oil cups at a distance. Shape a small ball from a piece of cork and coat it with red fingernail polish. Dropped in the oil cup, it's a highly visible telltale even from some feet away. —*William B. Eagan, Louisville, Ky.*



Knurling Small Stock. In knurling small diameters with a hand tool, the method shown at right will minimize the tendency of the work to bend, and keep the tool square. Clamp the tailstock close to the end of the work and run the empty ram up against the knurling tool. Then start the lathe, feeding the tool along by the tailstock handwheel. As the work is knurled, it runs into the hole in the ram. A length equal to the ram travel can be knurled in this way. —*Henry Sevcik, Los Angeles.*



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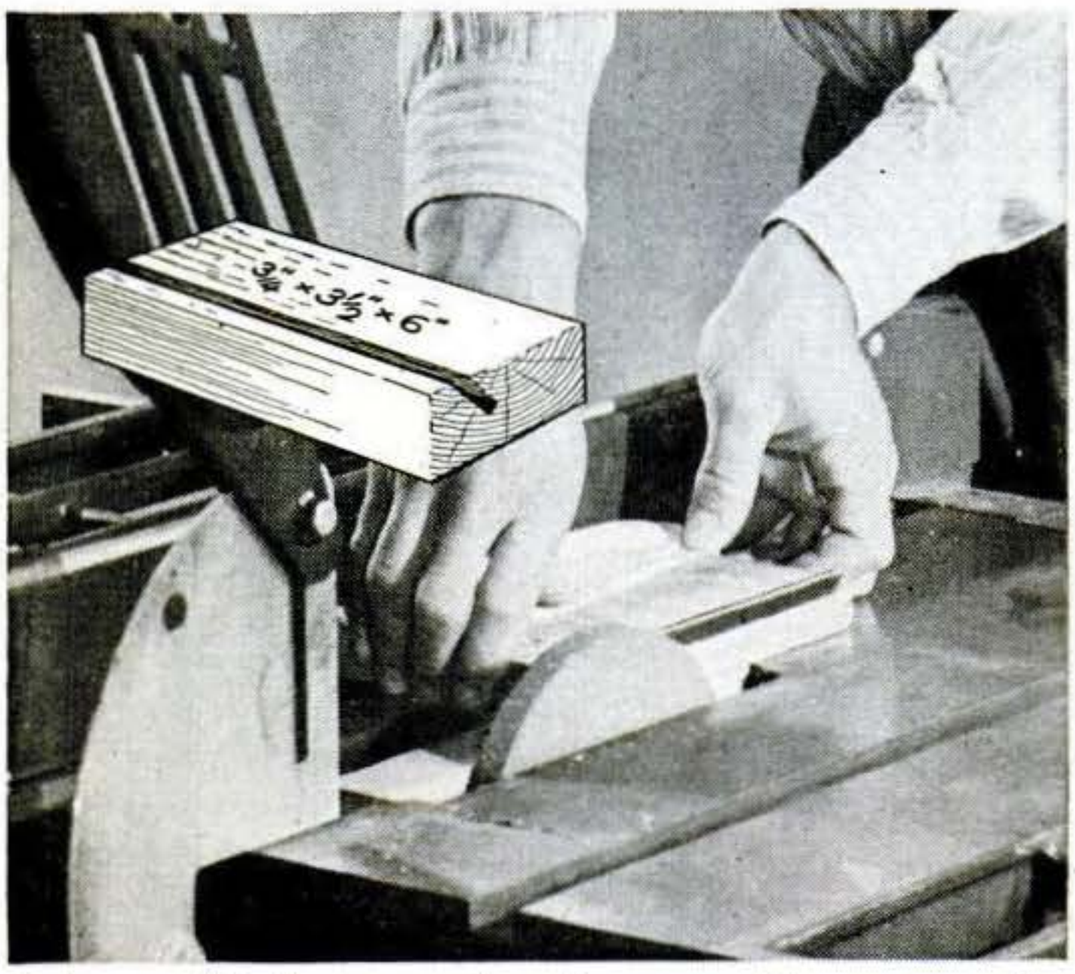
Keep 'Em Sharp

Jointers and shapers do their best work when their blades are keen. Here's how to keep them in tip-top shape.

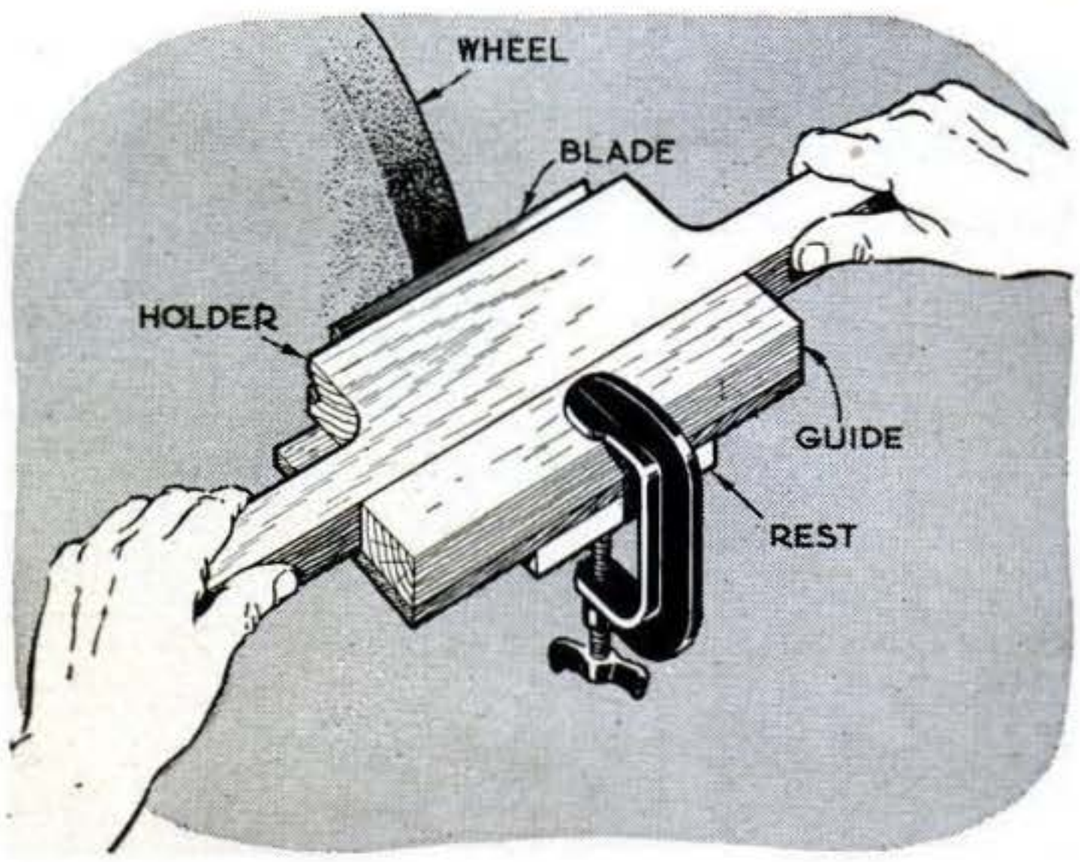
By Edwin M. Love

JOINTER blades cutting 4,200 shavings and shaper edges taking 10,000 bites a minute eventually get dull. Putting them in shape, however, is not difficult. It is a job, moreover, that yields considerable satisfaction.

Use a flexible-type abrasive disk wherever possible. In most cases you will not be able to use a guard on your circular saw. Wear goggles to protect your eyes and stand to one side when feeding the work into the disk.

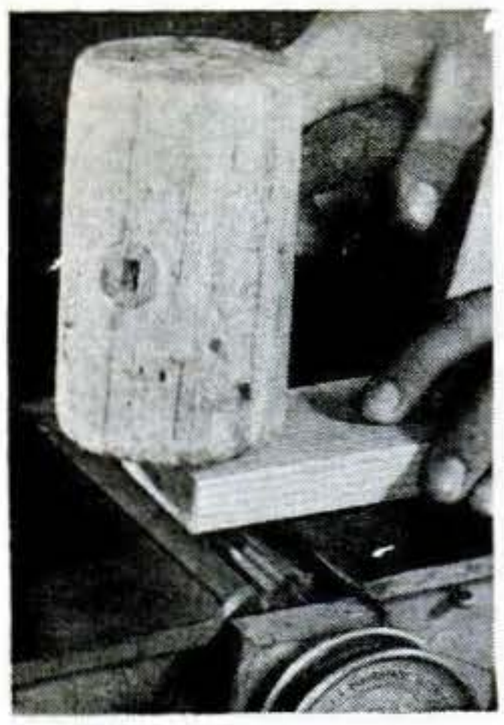


Jointer blades can be sharpened on a medium-grit grinding wheel mounted in a circular saw. Mount the blade in a slotted wooden block. One or two passes on the circular saw will cut the slot, which is made with the table or arbor tilted to the bevel angle. The slot should be snug enough to grip the blade firmly. Force the blade in by hammering on a block held against the blade's edge. Set the fence so the edge of the blade barely touches the side of the wheel. Make single quick passes across the wheel. Feed the blade to the wheel by inserting slips of paper between the block and the fence. Air-cool blade between passes. After grinding, hone blades with oilstone to remove burrs.

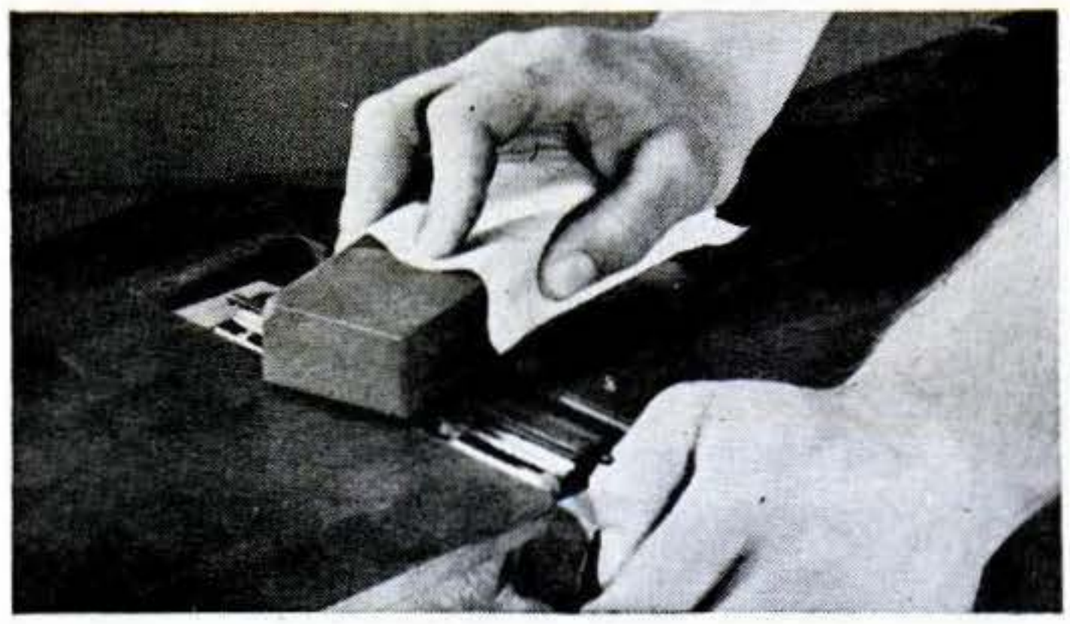


Bench grinder also can be used to sharpen jointer blades, as shown in the sketch above. To avoid burning the blade, take the lightest possible cuts and air-cool the blade between passes. The tool rest can be adjusted to the correct clearance angle.

Whetting the blades as shown below will serve if they are only a little dull. Lower the infeed table well below the blades. Slightly lower the outfeed table until a straightedge laid on it bears across the entire face of the bevel. Lock a blade in this position by wedging the pulley with a tapered piece of wood. Wrap part of an oilstone in paper to keep it from scratching the table. Whet the blade with circular strokes, working from end to end. Count the strokes. When the edge is sharp, whet the other blades, giving each one the same number of strokes to wear down all the blades alike.



When replaced in the head, the edges of jointer blades must be parallel with the table and equally high. Clamp the blades lightly in the head and tap them down *(left)* with a block laid on the rear table. When all are positioned, tighten the retaining screws. Be sure the ends of the blades are carefully set and locked even with each other.



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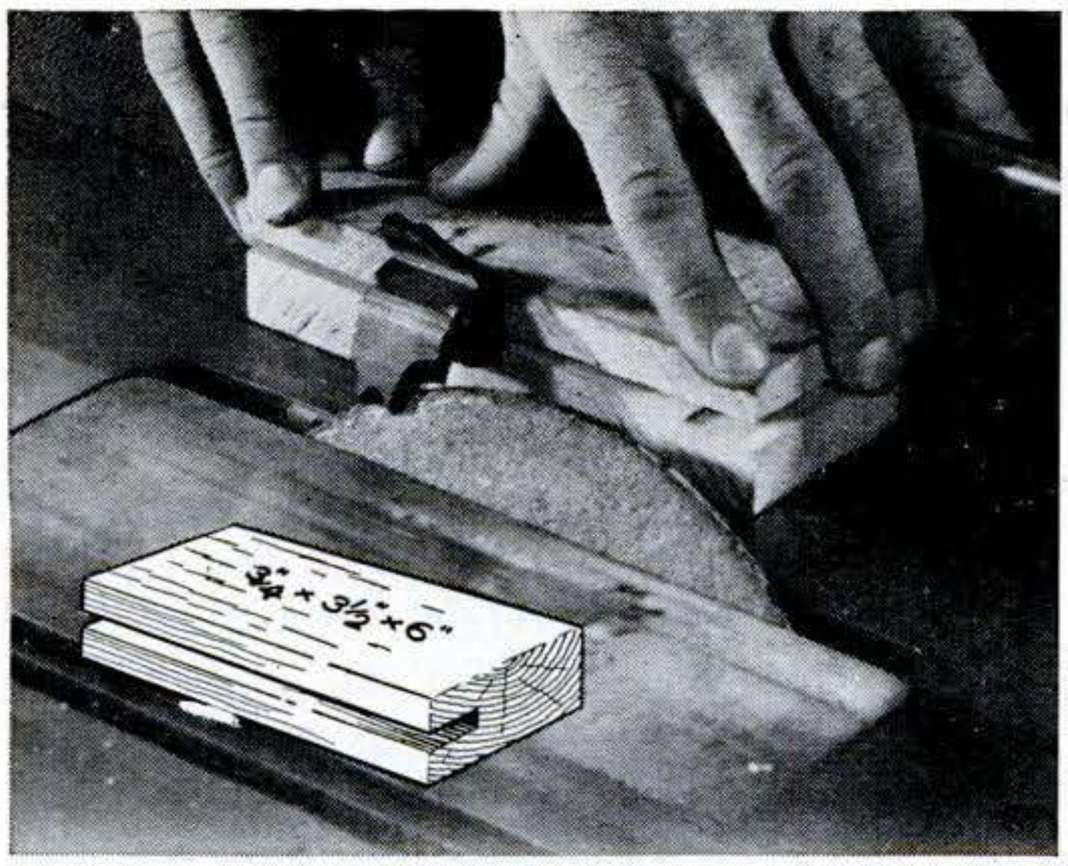
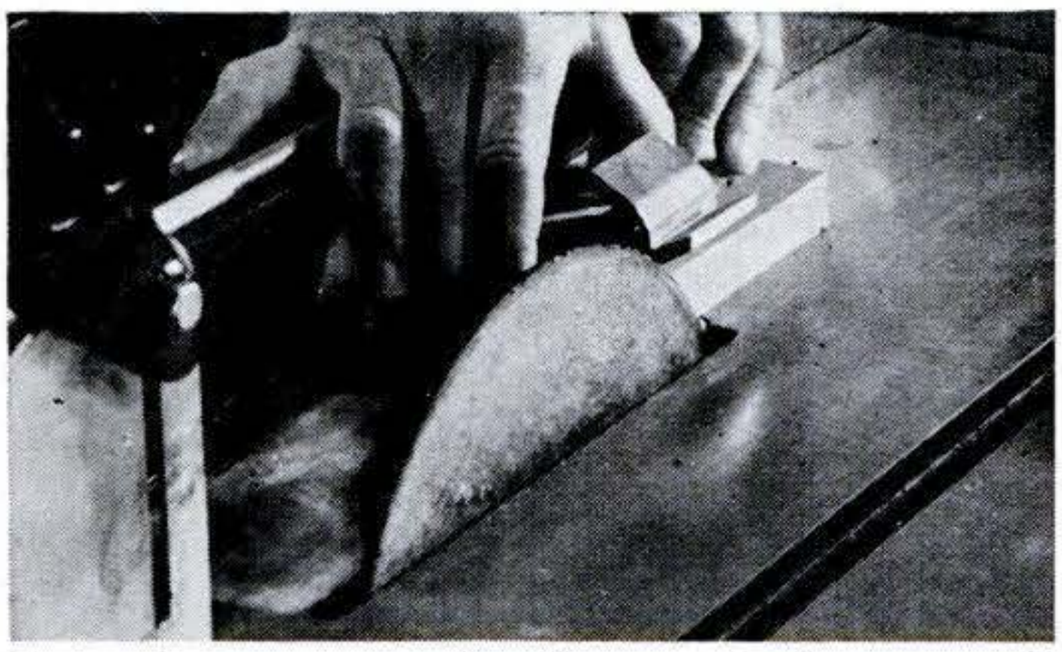
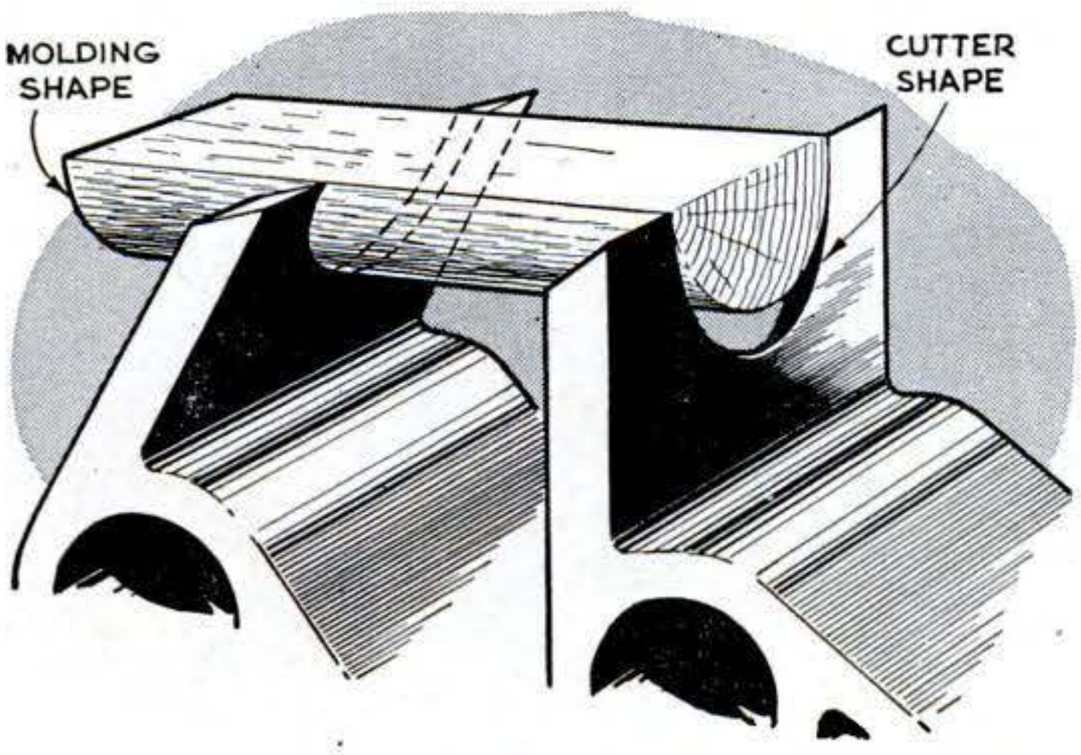


Shaper cutters can be sharpened with a fabric abrasive wheel mounted in a circular saw. The cutters are carried in a slotted block that is slid against the fence. Only the inner face, not the bevel, is ground. The wheel is tilted to match the rake angle. Because the wheel is springy, three or four passes can be made before you have to feed the block toward the wheel. After grinding, touch up the edges with a slipstone to get rid of the resulting feather edge.

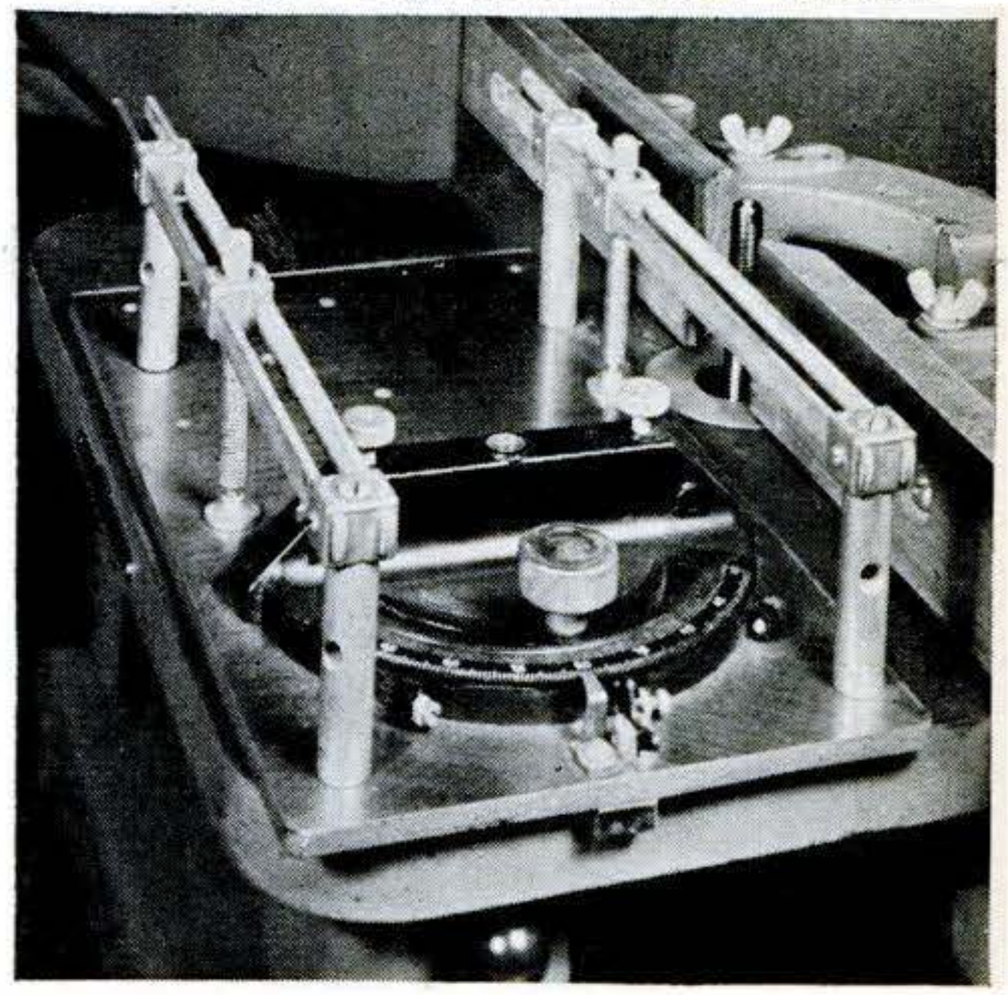


Straight cutters can be sharpened when pressed in a block that is slotted at an angle. Slide the block against the fence, grinding on the bevel. Make the same number of passes for each edge, or the blades will vary in length.



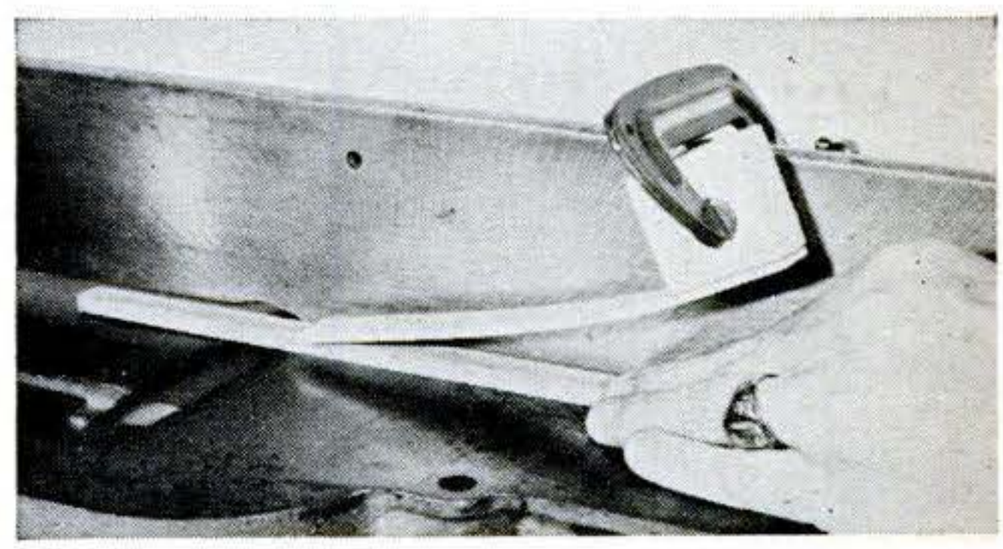
Because of the rake angle, the cutting edge of a molding cutter is not the same shape as the molding it will form, as shown in the sketch above. Remember this when selecting a cutter or grinding one to a special form.

New Shaper Jig Has Miter Gauge



THIS jig—said to be to a shaper what a miter gauge is to a circular saw—is offered by the Delta Power Tool Division, Rockwell Manufacturing Co., Milwaukee. It's designed especially for returning molding on narrow stock, shaping the ends of narrow pieces, beveling square stock, and so forth. Securely clamped by hold-downs, work is fed without danger of slipping, and your hands are kept safely away from the cutter. The gauge has quick-set stops.

Spring Improves Jointer



THIN strips of wood usually have a tendency to flex up from the knives of a jointer, resulting in an uneven cut. A wooden spring—like the one shown above—takes care of this problem and also keeps your fingers away from the cutters. It's a wooden strip ⅛" by ¾" by 7" nailed and glued to a ¾" by 1½" by 1½" block. Clamp the block to the fence so the end of the strip is very close to the knives. In the photo the blade guard was removed to get a clearer view of the spring. It's not necessary or advisable to remove the guard when using the spring. *—Tom Griberg, Moline, Ill.*

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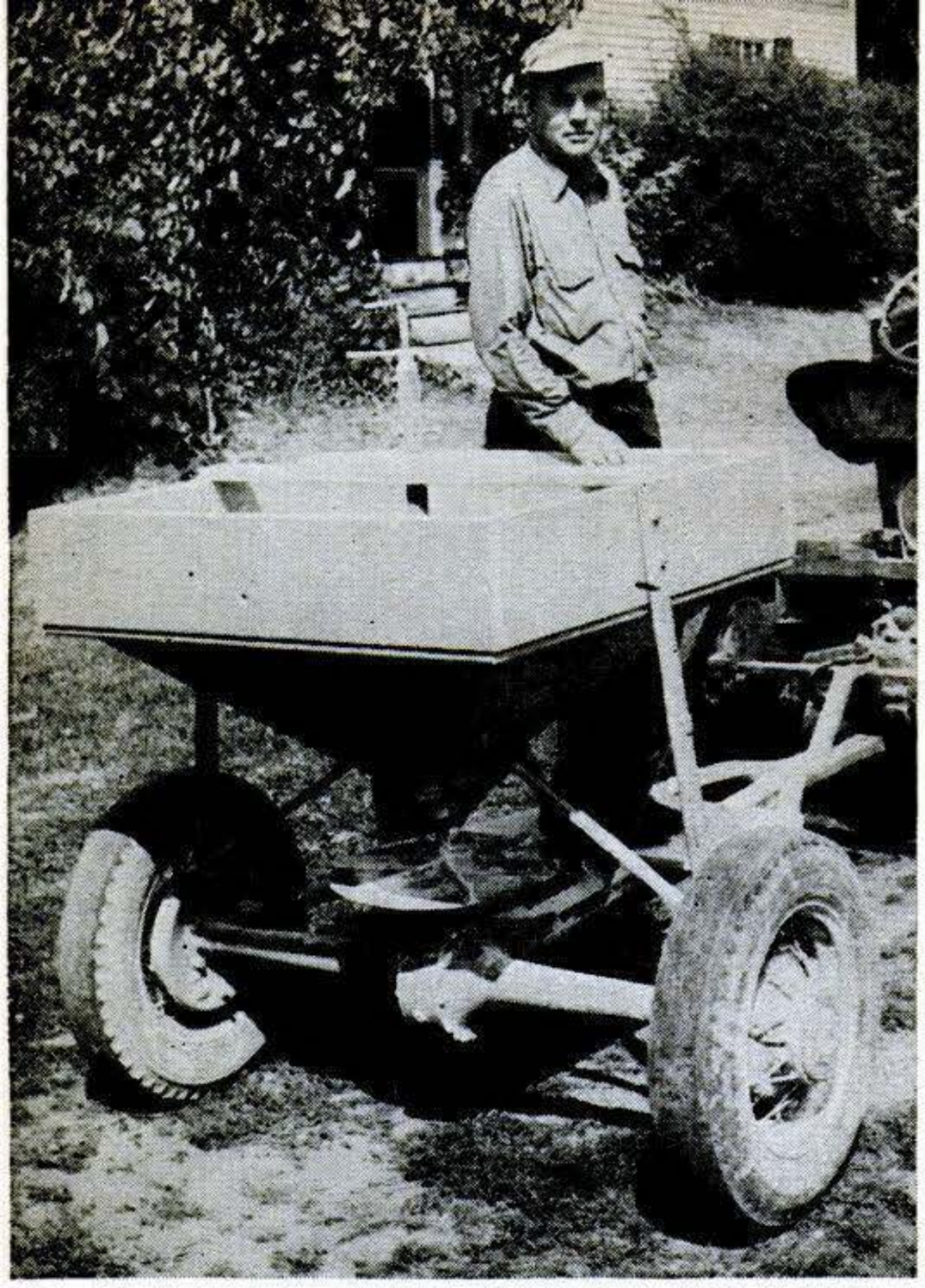


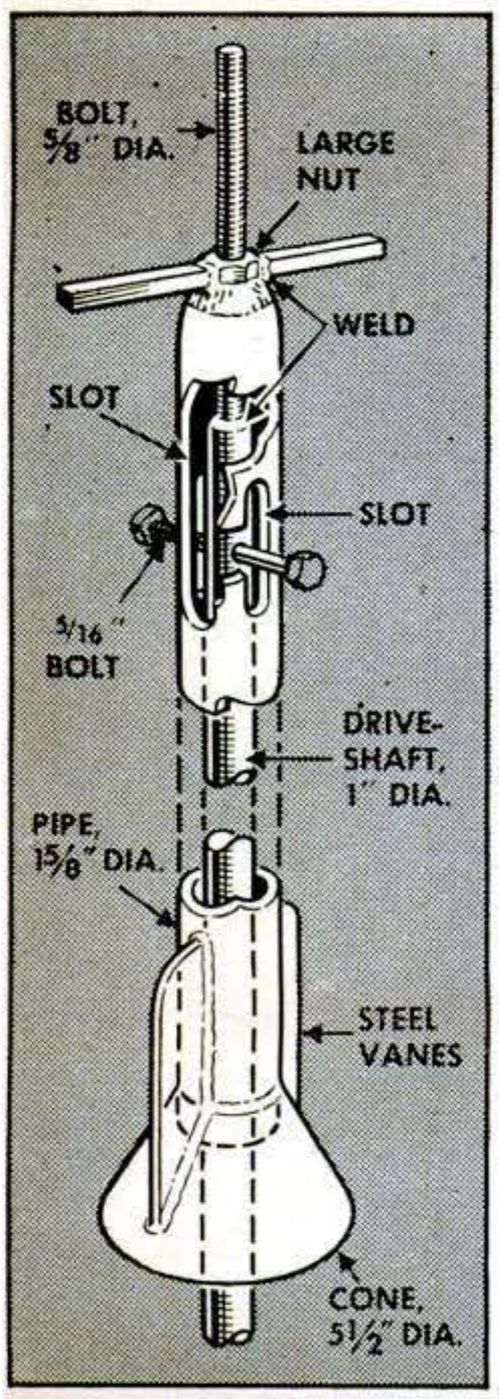
Model-A rear-axle assembly forms the chassis. Here, builder Howard Jenkins shows how the operator can ride on drawbar platform in field.

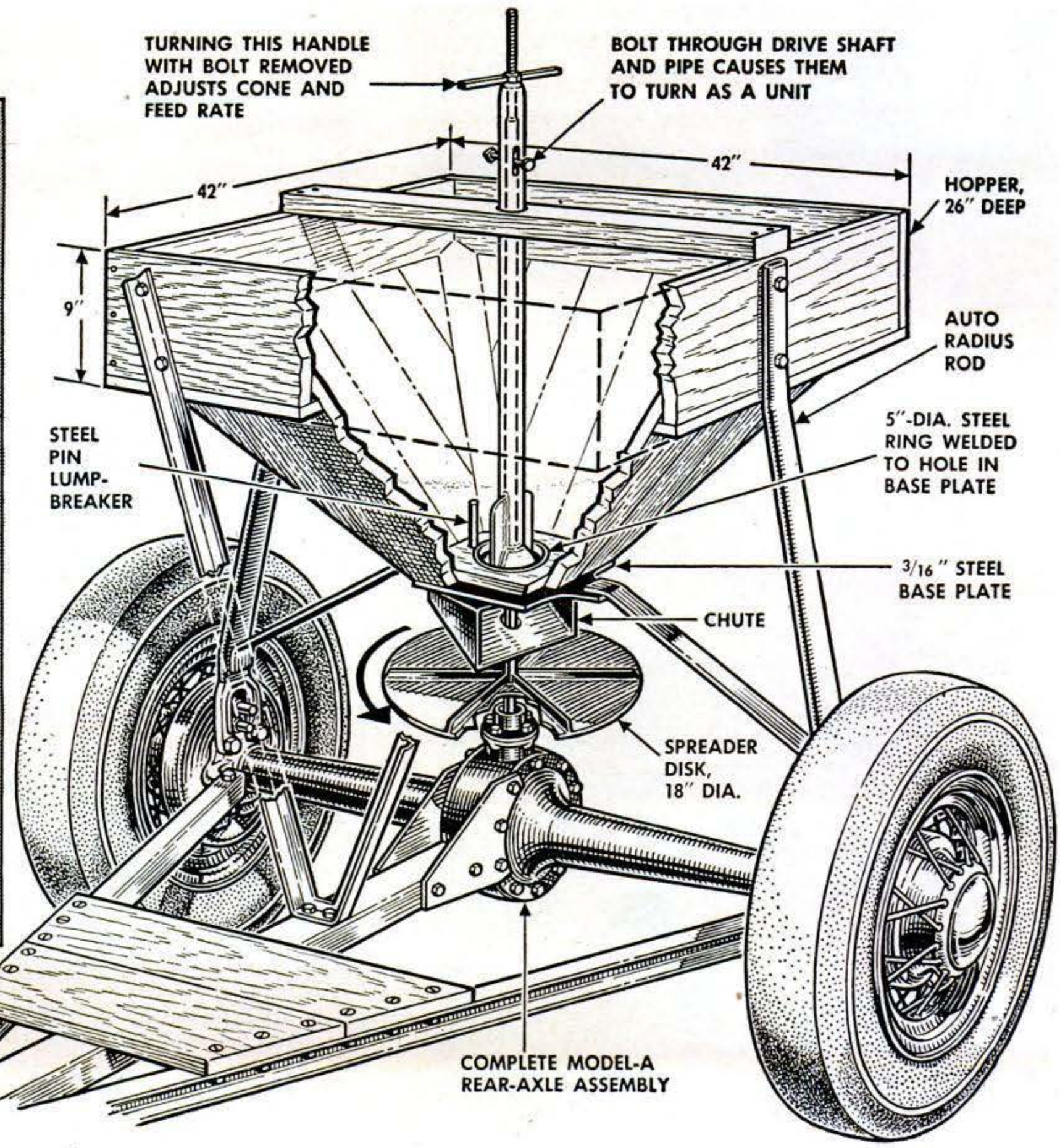
Model-A Now Spreads Lime

TO BUILD this lime spreader, a New Hampshire farmer salvaged the complete rear-axle assembly from a Model-A Ford and swung its propeller shaft straight up. In the car, the shaft drove the wheels. In the spreader, the wheels turn the shaft. A webbed disk welded to the shaft broadcasts lime over a path about 10 feet wide as a tractor tows the spreader.

Lime can be fed at varying rates by raising or lowering a sheet-metal cone on a pipe that encases the drive shaft. The pipe is welded to a large nut that turns on a ⅝" bolt welded to the end of the cut-off drive shaft. A lock bolt causes the pipe and cone to revolve with the shaft.

A chute screwed to the hopper base delivers lime to the disk. Swung vertically, the Ford radius rods help support the hopper.—*Charles L. Stratton, Hollis, N. H.*





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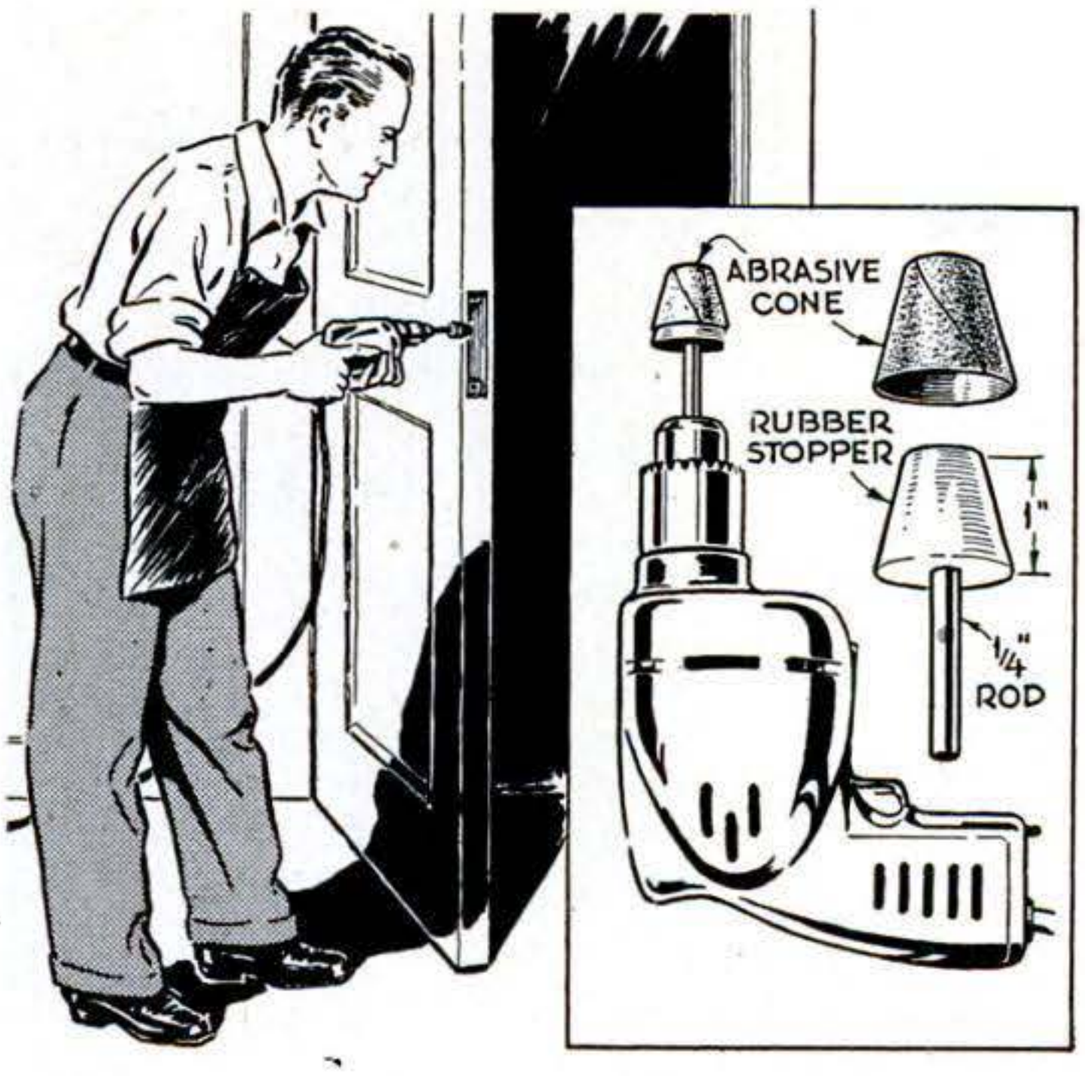
Stopper Serves as Grinding Head



You can make a practical grinding and polishing head for a drill or motor chuck from a No. 6 rubber laboratory stopper. Force the stopper over a short length of ¼" rod and chuck like a twist drill. From abrasive paper, cut out and glue together conical shells to fit the stopper. Be sure to overlap the edges so that rotation won't open the seam. The taper of the stopper will hold the shells firmly, but they can readily be changed—*J. G. Schad, Pittsburgh, Pa.*

Need a Clamp for Small Parts?

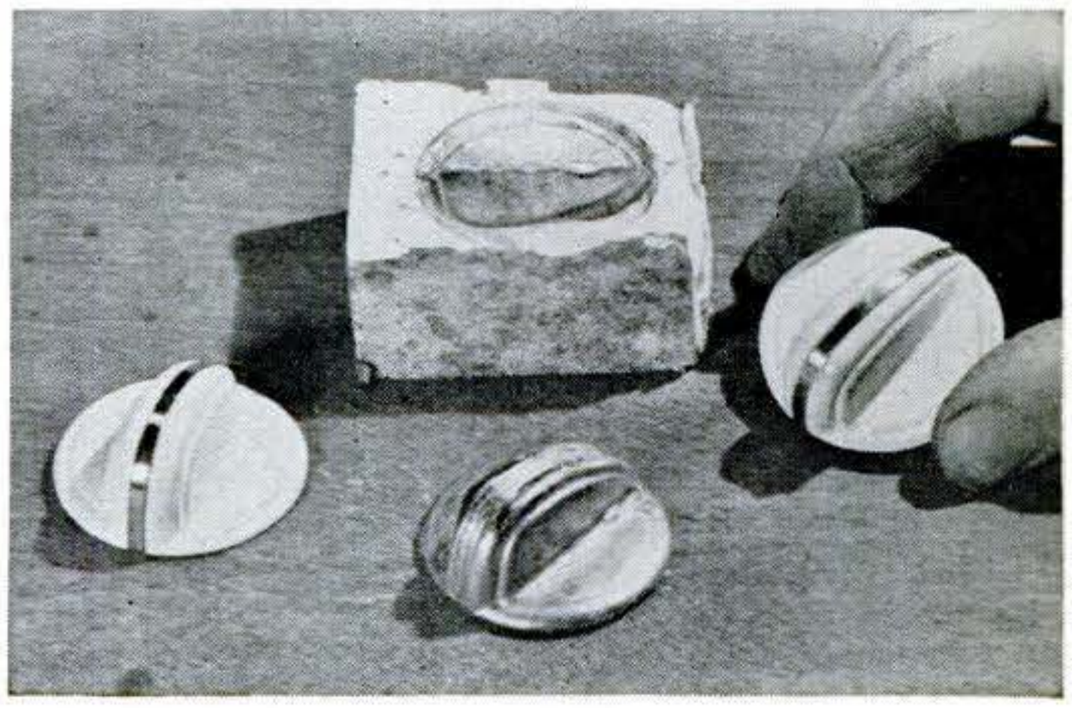
Have you ever thought of using a trouser hanger as a handy clamp when you are gluing up small pieces?—*Mrs. S. Sorensen, Mira Loma, Calif.*

Plastic Keeps Ink Stopper Free

Stoppers of India ink bottles tend to stick and eventually break off in the bottle. To prevent this, cut a disk of vinyl sheeting about 1¾" in diameter. Punch a hole through the center of the disk and slip the stopper through it. Vinyl plastic is highly resistant to both acids and alkalies and also can be used to protect corks used in bottles of soldering flux, ammonia, and many other chemicals that are commonly used about the shop. —*Andrew Brennan, Philadelphia.*

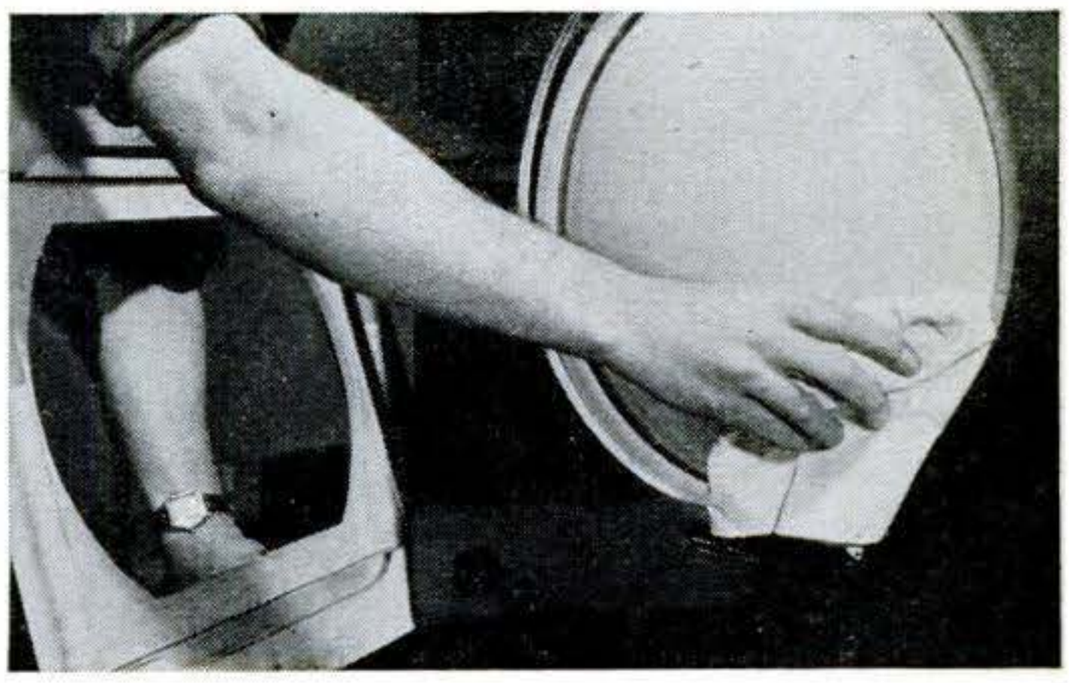
Match Your Knob in Lead

If you can't match that broken knob on your stove, cast a new one yourself from lead. Using one of the remaining knobs as a pattern, make a plaster of Paris mold. Oiling or greasing the knob will make it easy to remove it from the hardened plaster. When the mold has dried thoroughly, use it to make a lead casting. File off any roughness, drill the necessary mounting holes, and finish the casting to match the original knob. A lead casting as it came from the mold is shown at center in the photo below. The knob, after finishing, is shown at right. Tin-can stock furnished the metal trim.



Dust Dims Image on TV Screen

Dust that settles and bakes on the face of the image tube steals life and brilliance from the picture. To keep your TV picture bright, keep the tube face clean. Take off the safety mask and wash the tube face with a damp cloth or window cleaner. Wipe it with a soft, lintless cloth. Do the same to the inside surface of the safety mask. If you can't easily remove the mask, chances are that the tube is protected by a built-in dust shield and doesn't need cleaning.



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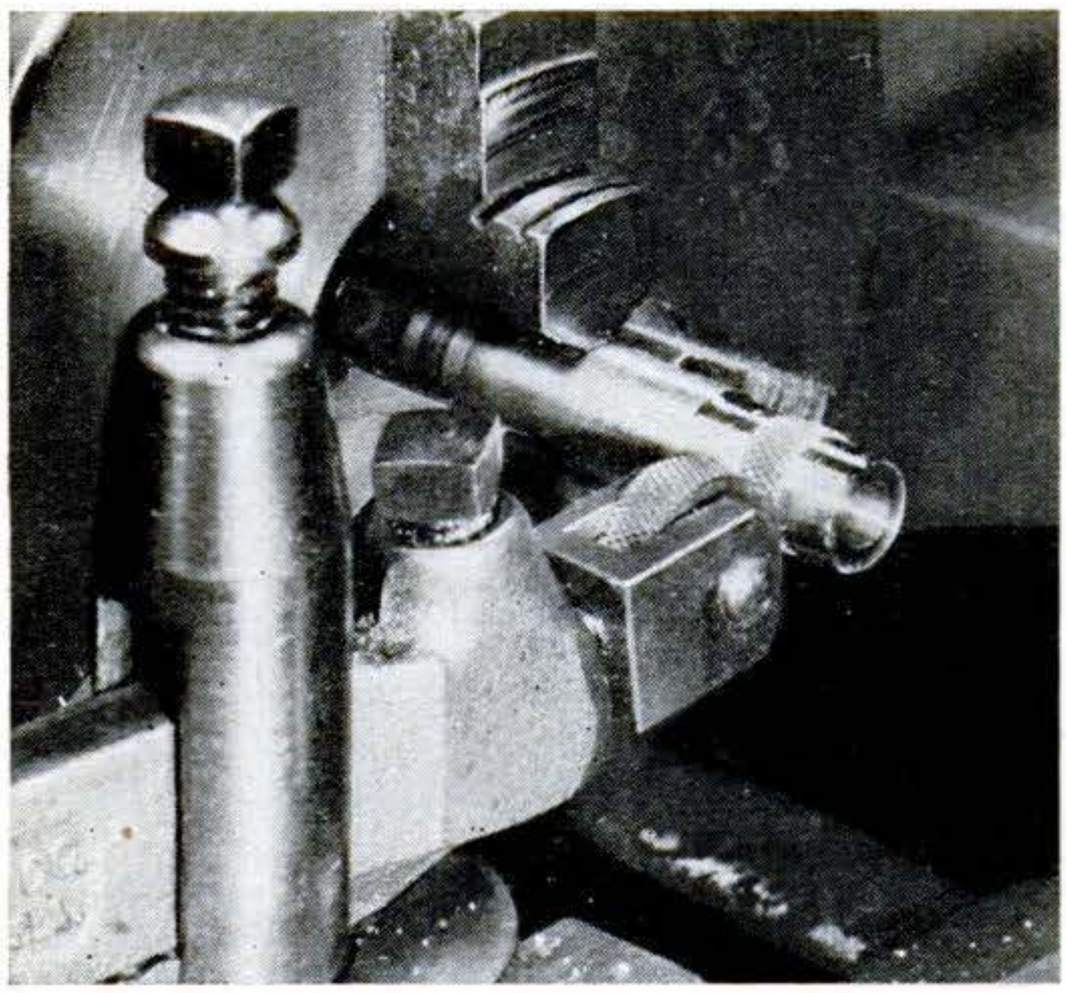
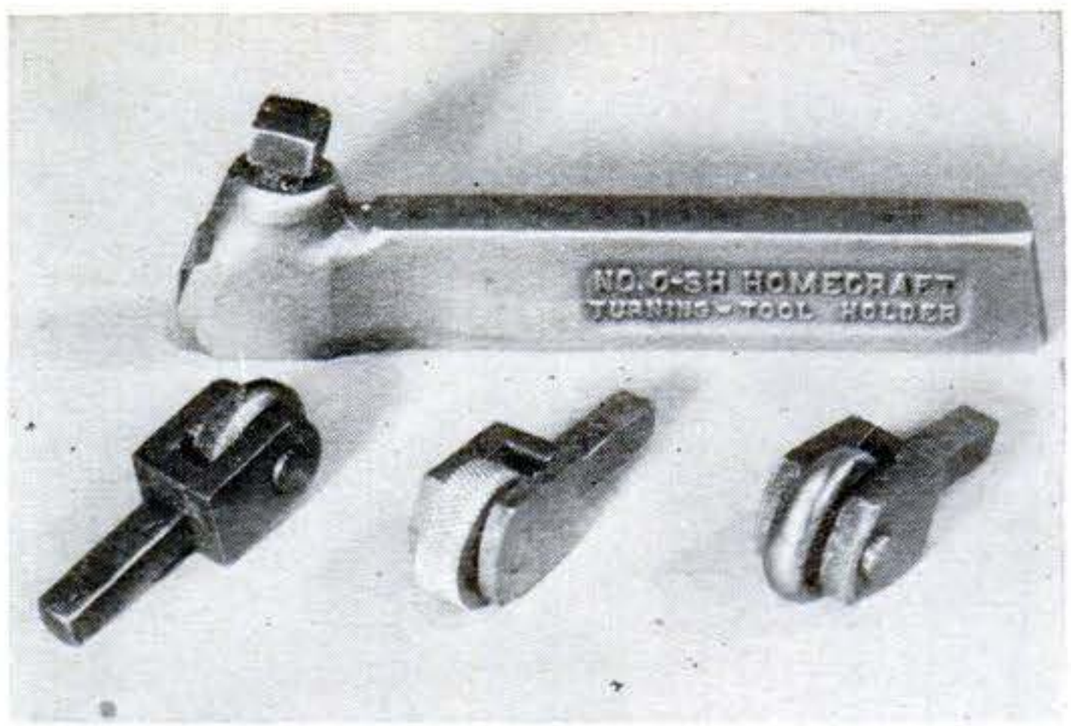


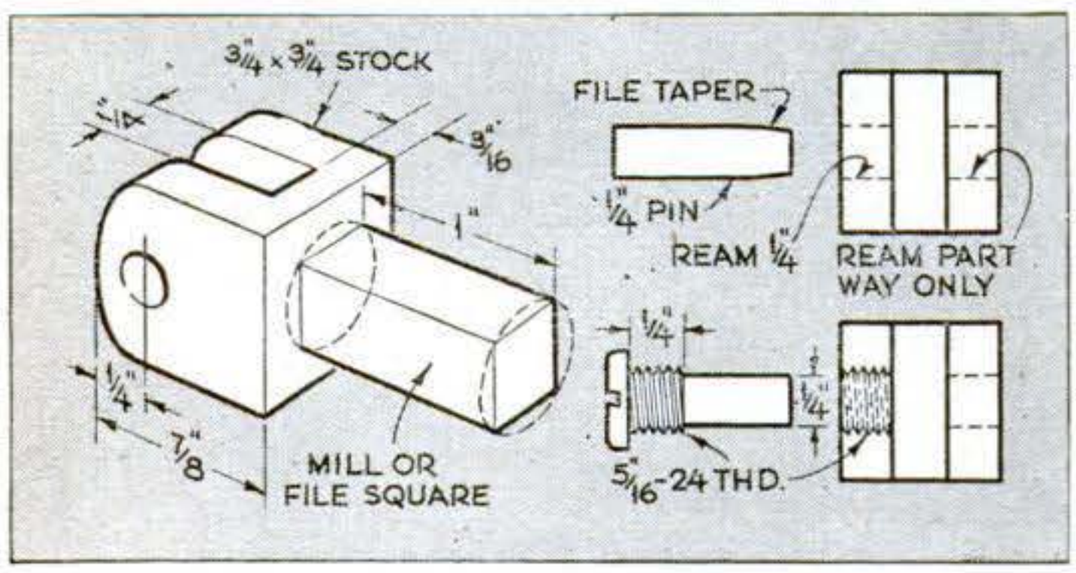


Replacing the tool bit, these individual knurling wheels can be mounted in a moment. Above are shown two types of knurling wheels and a homemade metal-spinning wheel. The latter has seen hard service on short production runs.

Individual Knurling Tools Inserted Like Bits

WITHOUT once changing tool holders, you can switch from turning to knurling and back again by inserting these individual knurl holders. For the price of a single wheel of each kind, you can do every kind of knurling. A wheel with a radius on its edge, turned from drill rod and hardened, does a good job of metal spinning.

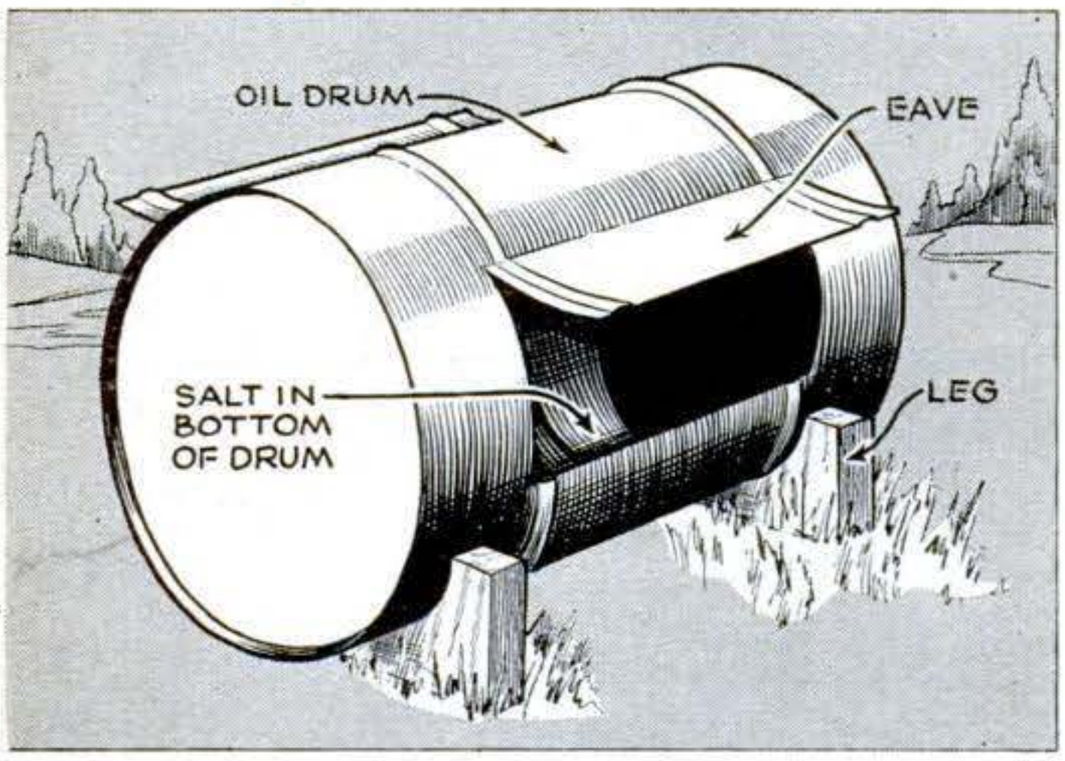
To make each holder, chuck a 2″ length of ¾″ square steel in the four-jaw and turn it down to ¼″ about halfway. Remove it from the lathe and mill or file this portion square to fit a tool-holder socket, making the sides parallel to the ¾″ ones.



Drill a ¼″ hole near the bottom of the slot. Saw to it and file out the slot clean and square. Drill the cross hole undersize and ream to ¼″ just short of its full length. Cut the pins from drill rod, file a short taper at one end for a drive fit in the hole, and harden. Polish the pins and reheat to draw the temper to a deep straw color at the center, where the wheels ride.

If you want to make wheels interchangeable in one holder, turn the pins with a threaded shoulder to fit a tapped hole in one side of the holder fork.—*Floyd McGuckin, Ridgewood, N. J.*

Oil Drum Holds Salt for Sheep



AN OIL drum with openings cut on opposite sides makes a handy portable salt trough for sheep. Screw the drum to blocks as shown or weld on angle-iron legs.

Broom Squared on Circular Saw

BROOMS that have become lopsided from wear can be squared off easily on a circular saw. Cut two pieces of wood 3″ or 4″ wide and about 4″ longer than the broom's width. Cut two small pieces about 1″ or 1¼″ thick for spacers. Lay the broom on one of the long pieces, place spacers on either side of it, and top with the other long piece. Nail through the three pieces at one end. Push up the other spacer to compress the broom firmly and then nail through. Nail on outer edges only. Set the blade so it cuts into but not through the top piece.

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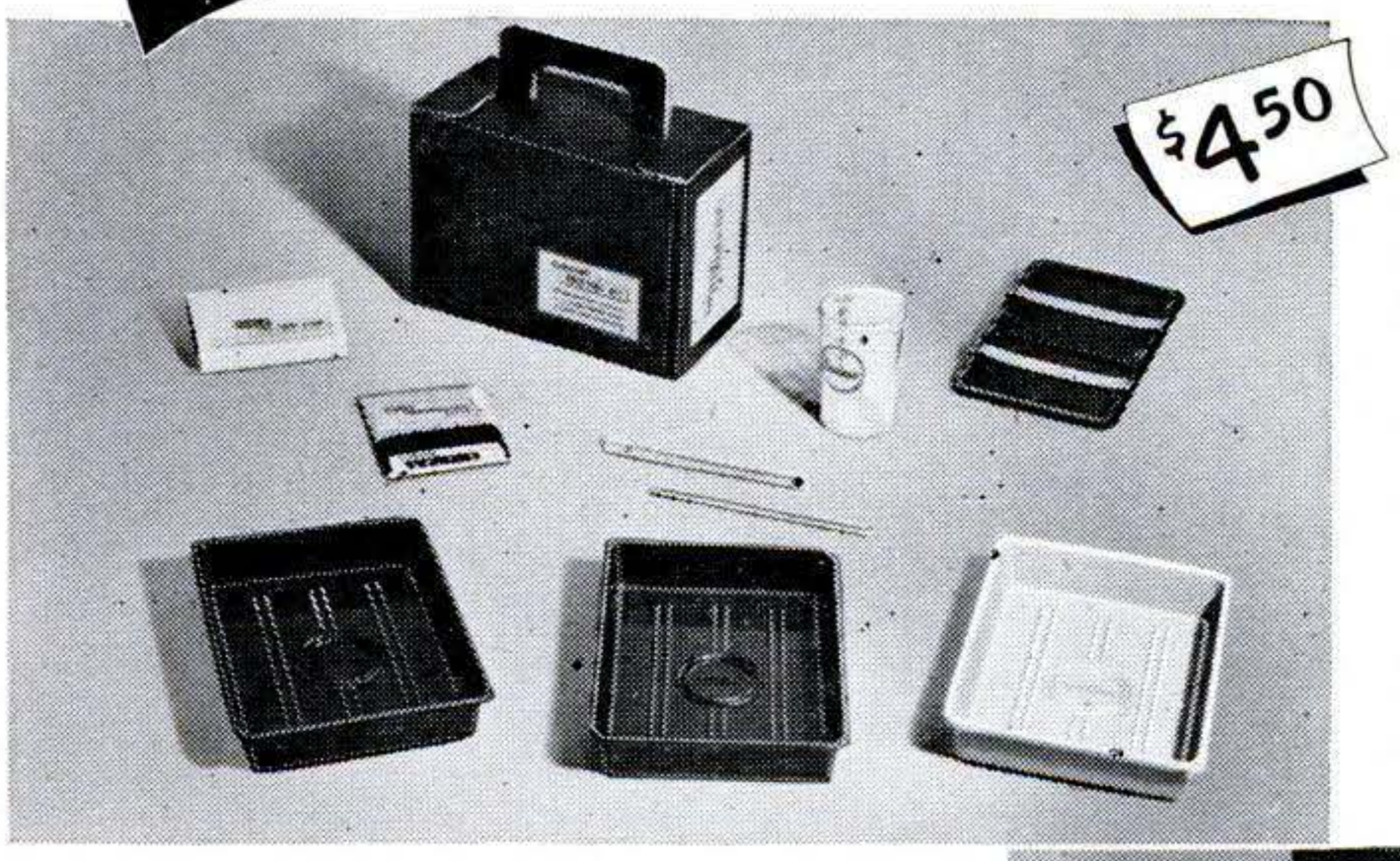

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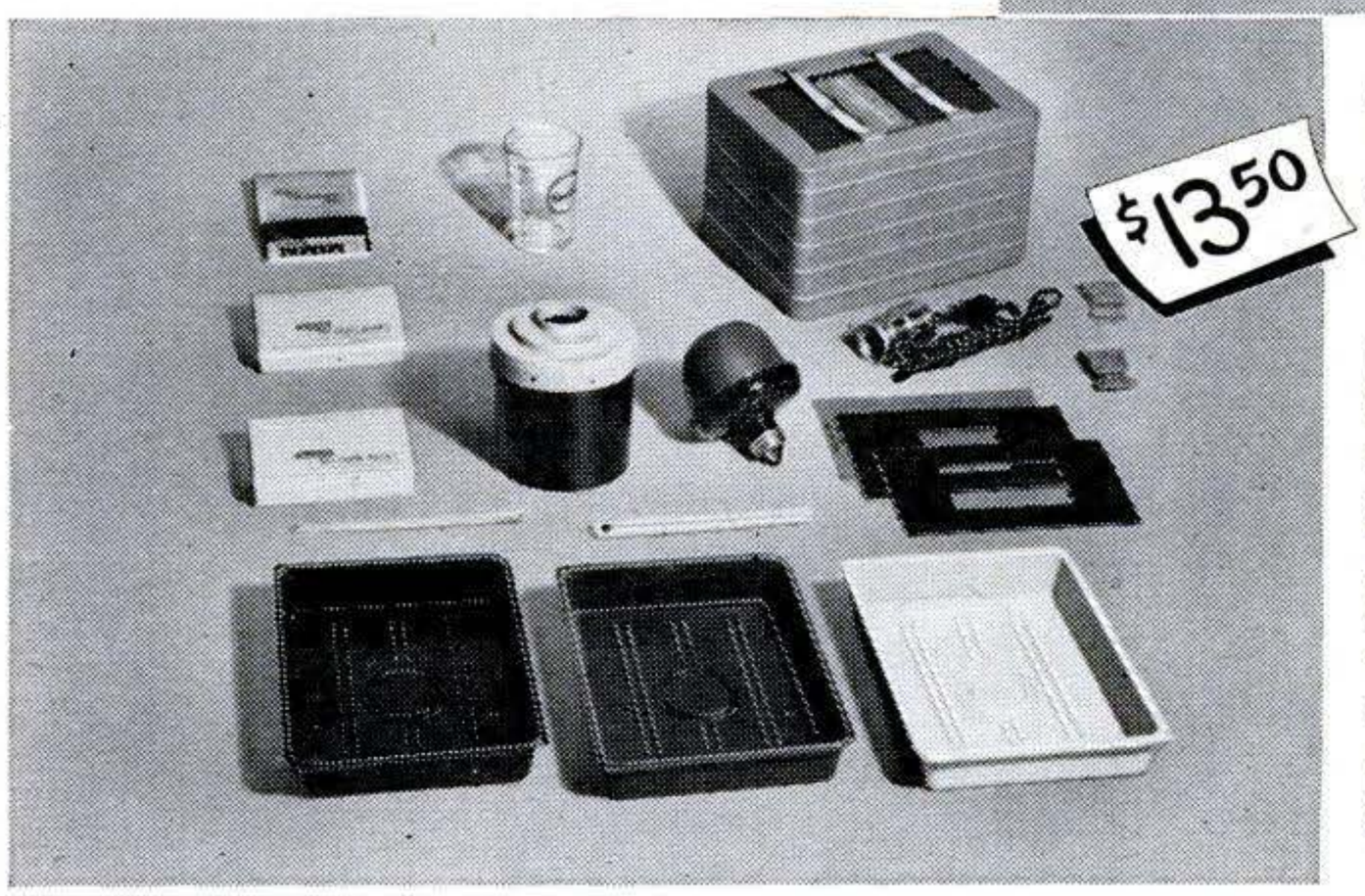
- 2 Kodak Tri-Chem Packs
- 1 8-oz. Plastic Graduate
- 1 Kodak Darkroom Thermometer
- 2 Kodak Junior Film Clips
- 1 Complete Instruction Book



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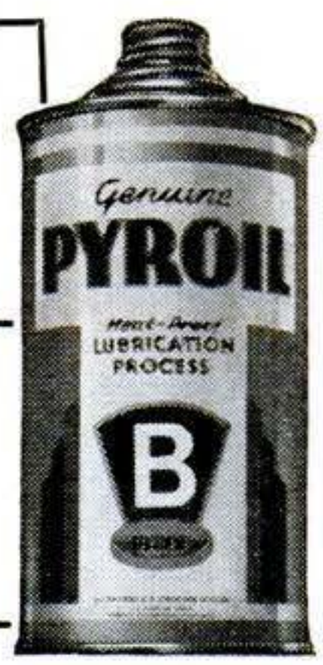

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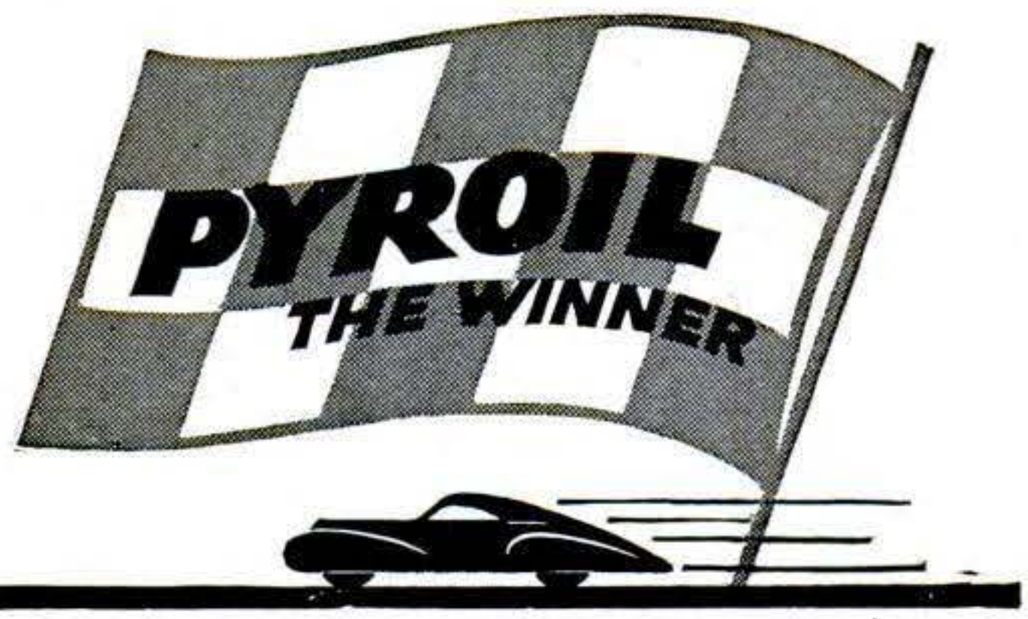

Gus Tames a Runaway Engine

[*Continued from page 184*]

from his motor. He maneuvered the coasting car to the shoulder of the road, and, almost before the car had come to a stop, Gus was out, had the hood up, and was directing the beam of the flashlight at the engine. Just as Jim joined him, there was a click and Gus noticed that the throttle rod to the carburetor snapped back into what was evidently its idling position.

"Did you see that?" queried Gus.

Jim nodded.

"I think we're getting some place," Gus said hopefully. "Let's try her again."

After the two men had climbed back into the car, Jim pushed the starter and the motor caught without a falter.

"Now bring her up to forty again slowly," Gus instructed, "and the minute she runs away and then begins to sputter pull over to the side of the road."

Fast Footwork Aids Diagnosis

They didn't have to wait long before things started to happen again, and when they did Jim followed his instructions. Gus jumped out of the car, flipped open the hood, which he'd left unlatched, pulled off the air cleaner, and aimed his flashlight into the carburetor's throat.

"Take a look down there," Gus said after a quick inspection. "Even a carburetor's throat can develop tonsils."

Jim looked. There was at least a half inch of white ice blocking the throttle valve. As he watched, he could see the ice melting and suddenly there was that familiar metallic click he'd been hearing each time after his engine had died.

"There's your trouble," Gus said, tapping a metal tank mounted on the fire wall that held the water supply for Jim's water injector. "Your carburetor has been icing up because of the water you've been adding to your fuel."

"But Gus, the temperature hasn't dropped below freezing for weeks," Jim reminded him. "I know the manufacturer's instructions said not to use the injector when the weather dropped below thirty-two, and I haven't. As a matter of fact, when we left the house tonight it was a balmy forty-two."

"Outside, yes," Gus corrected, "but not inside your carburetor."

"Well, what a dope I've been," Jim groaned as he thumped his forehead with

[*Continued on page 236*]

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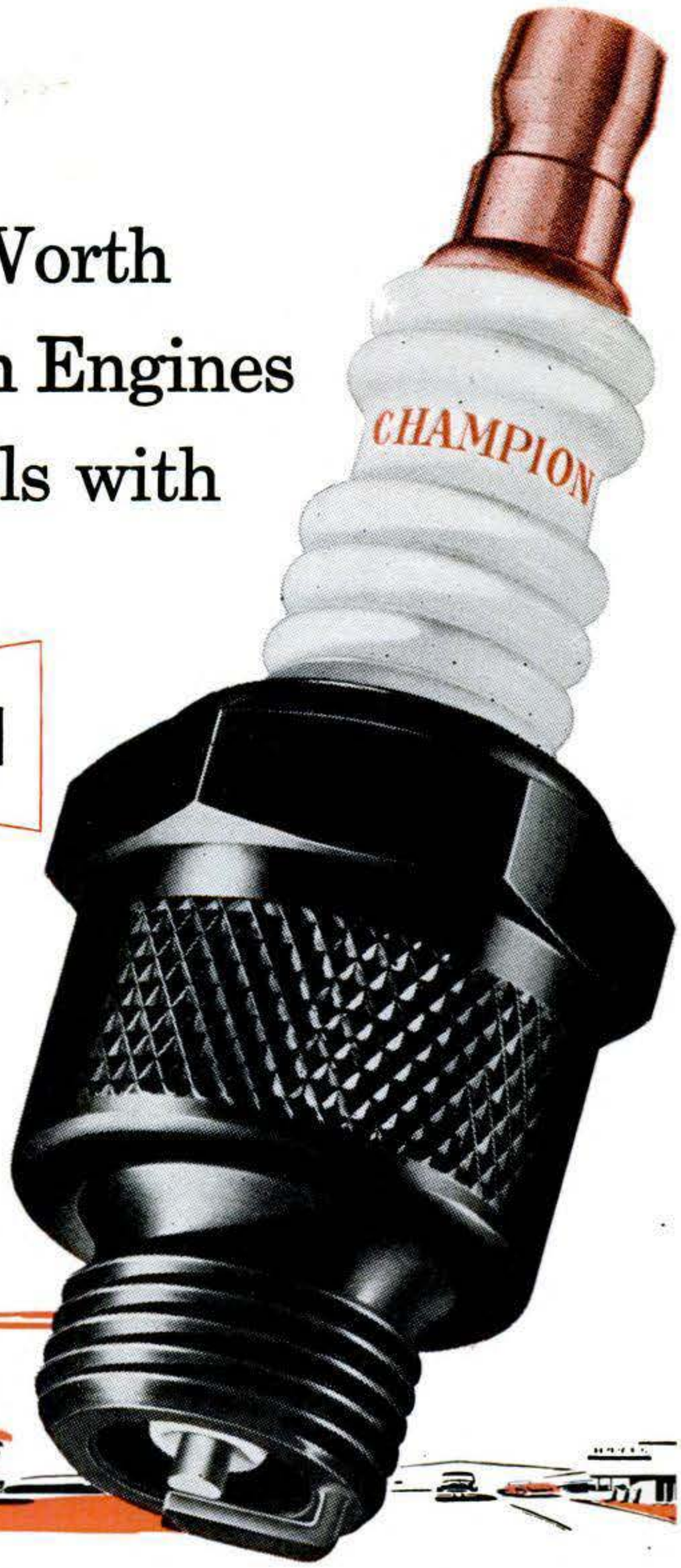

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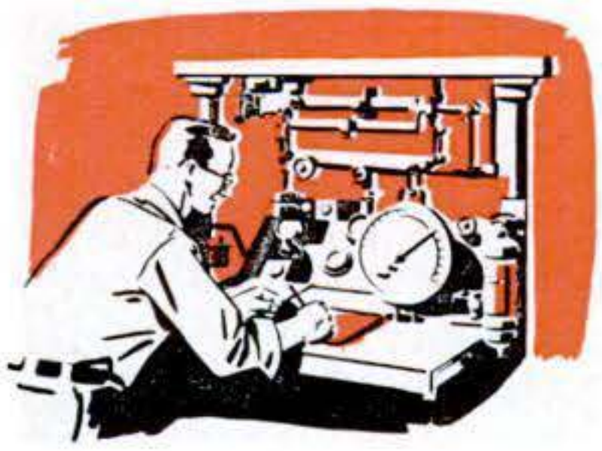

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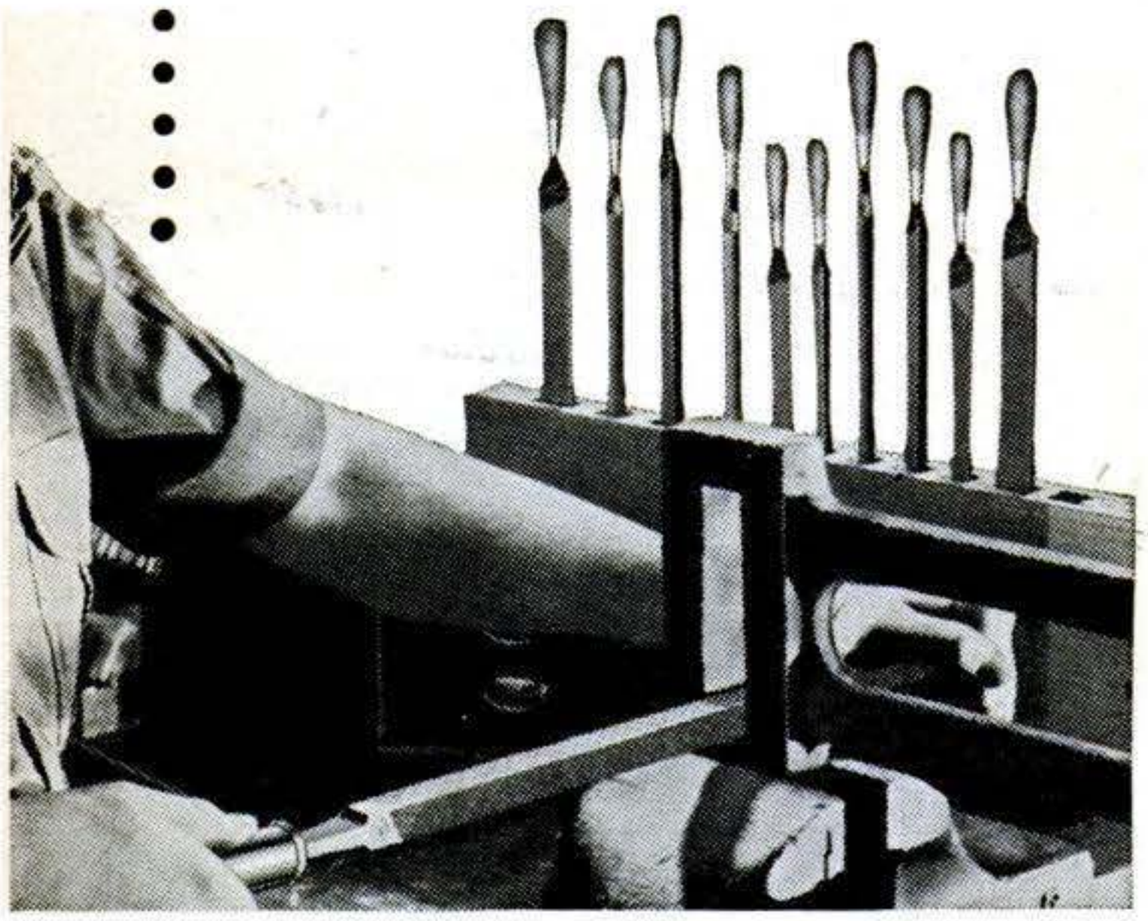

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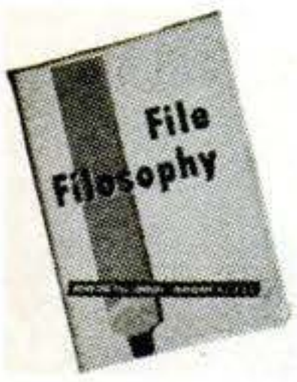

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BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

Gus Tames a Runaway Engine

[Continued from page 234]

his fist. "A fine budding engineer. Of course, the venturi effect in the carburetor acts like the expansion valve in a refrigerator—it lowers the temperature."

"Right, and the temperature in the throat of a carburetor can be quite a bit below freezing even if the outside temperature is above freezing," Gus explained. "What's been happening is that first just enough ice has been forming at forty miles an hour to hold your carburetor throttle valve open at that position. Then as more and more ice has formed it has choked off the carburetor throat and starved the engine. Finally, when she did stall, it didn't take long for the heat of the engine to melt the ice and you were all set to go again."

"Live and learn," Jim grinned as he reached in under the hood and turned the petcock that shut off the water for the injector. "I guess about the only alibi I've got is that I'm an electrical engineer."

Causes Forced Landings, Too

"Well, at least you were a doughfoot and not a fly-boy in the last war," Gus said as they started back to town. "If you'd been a pilot, you'd have known that airplane carburetors often ice up under certain damp weather conditions in the summer when the outside temperatures are soaring in the nineties. That's why they put heaters in 'em."

"Well, since I don't have a heater in mine," Jim replied, "I guess I'll just have to forget about my water injector until warmer weather sets in again."

"Not necessarily," Gus corrected. "You can always add enough alcohol to the water in the tank to prevent freezing. As a matter of fact, the alcohol will add to the pep of your engine. Some injectors are designed to operate only on an alcohol-and-water mixture."

"Thanks a million, Gus," Jim said as he slowed the car to stop in front of Gus' house. "Now I can take off for home tomorrow night on schedule. Mom and Pop sure would have been disappointed if we hadn't been able to get together. Happy New Year, Gus."

"And a Happy New Year to you, Jim," Gus said shaking Jim's hand. "And while you're driving, look out for those holiday-happy goons who think they can mix alcohol and gasoline *without* an injector." END

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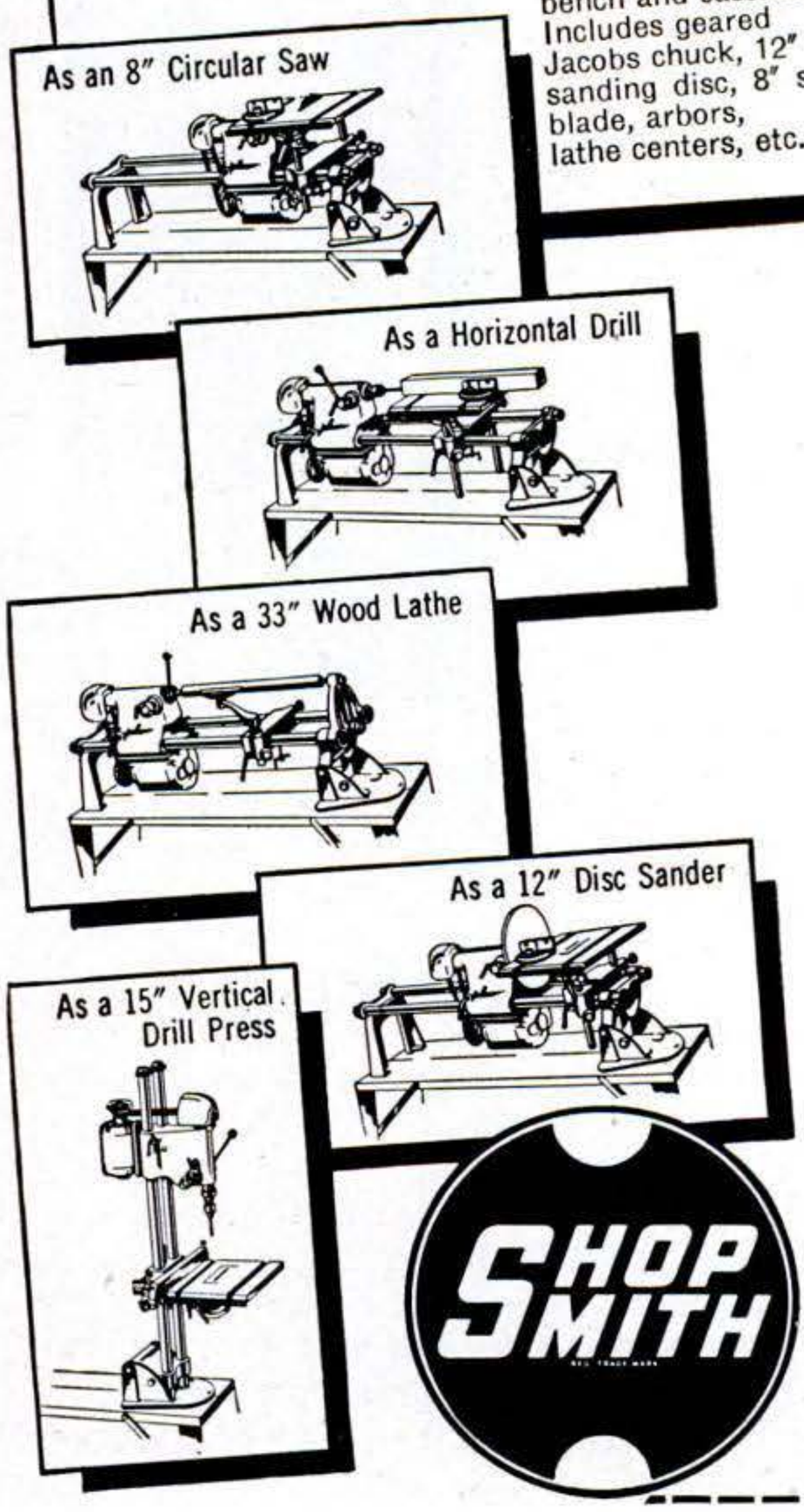
$189.50 complete except for motor, bench and casters.* Includes geared Jacobs chuck, 12" sanding disc, 8" saw blade, arbors, lathe centers, etc.



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SHOPSMITH packs more tricks than a magician's kit! You can move it! Change it! Set it up to do 1001 work-saving jobs. You can saw full-size plywood panels without help. Drill room-length planks. Dowel perfect joints without jigs. Sand ends and joint edges to hairline dimensions. What's more, you can change SHOPSMITH from one standard tool to another *in less than sixty seconds.*

Add to its flexibility, SHOPSMITH's remarkable accuracy, its tremendous capacity, its rugged precision, and you'll understand why SHOPSMITH is the largest-selling power tool in America today.

See for yourself what SHOPSMITH can do — at leading hardware and department stores or any Montgomery Ward store. And for a booklet jam-packed with information on SHOPSMITH, send the coupon.

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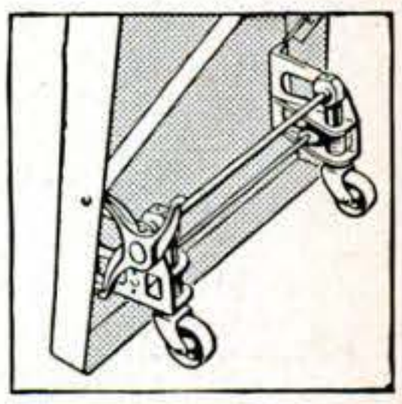
increase SHOPSMITH's already great flexibility. They're easily mounted on any wood or metal bench. Easy to set, too, with three-stage foot levers that raise or lower unit. Your SHOPSMITH dealer has them. Complete set.....$11.95



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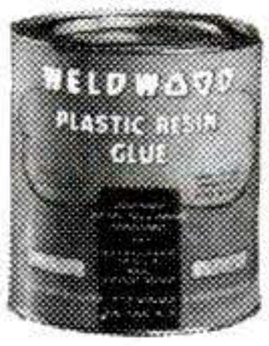

To make things or fix things, use Weldwood Glue for all wood-to-wood bonds. Makes joints stronger than the wood itself. Mixes easily with water. Stain-free, rot-proof . . . highly water-resistant! 15¢, 35¢, 65¢, 95¢ and larger sizes.

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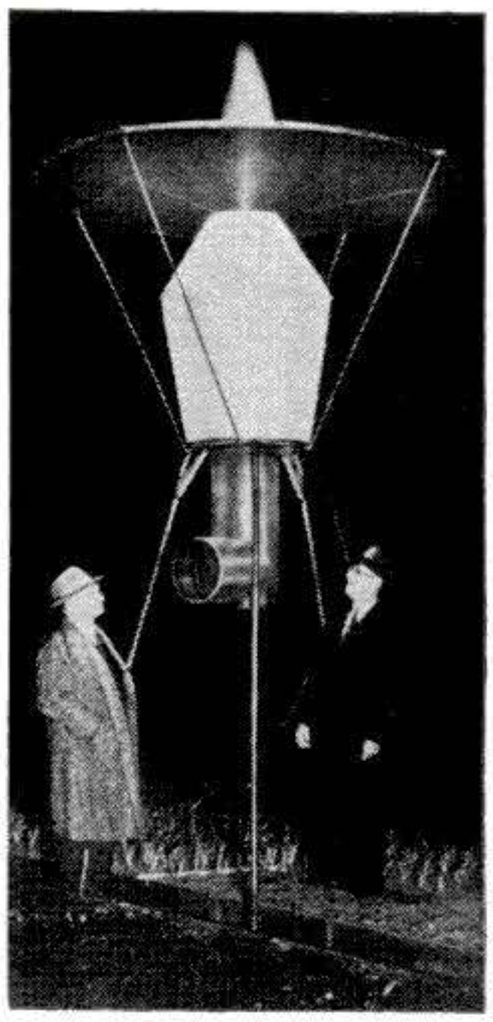
Mechanics of Farming

By Ladd Haystead

■ Frost has been one of the greatest threats to agriculture since man first started to farm in the north temperate zone. To combat it, he has tried bonfires, smudge pots, frozen mist, helicopters. None has been more than partly successful. Evans Products Co., Plymouth, Mich., thinks it has the real answer: a radiant heater that works on the principle of bathroom electric radiant heaters. It sends out infrared rays that heat only an object they hit, such as a leaf or fruit. Air in between is unaffected. The Frostguard (right) is a tubular-steel tripod supporting a combustion chamber and a 7-foot aluminum reflector. Kerosene or No. 1 oil, pumped by an electric motor, burns at 1,750° F. Fuel consumption averages 10 gallons an hour. (Killing frost usually lasts only a few hours.) Many test units have paid their $350 cost in one season. The company predicts that their use may lengthen the growing season as much as six weeks.



■ A two-row cotton picker--self-propelled, rotating-spindle type--is announced by Allis-Chalmers for limited production at its Gadsden, Ala., plant.

■ A few years ago one poultryman taking care of 1,000 to 1,500 birds usually was overworked. Now going up on a Southern farm are two mechanized, 12,000-bird houses that one man will run.

■ "You'll never mechanize dairying," they used to say. But U.S. Dept. of Agriculture reports the job is well under way. Electricity provides fences, pumps water, lights and ven-

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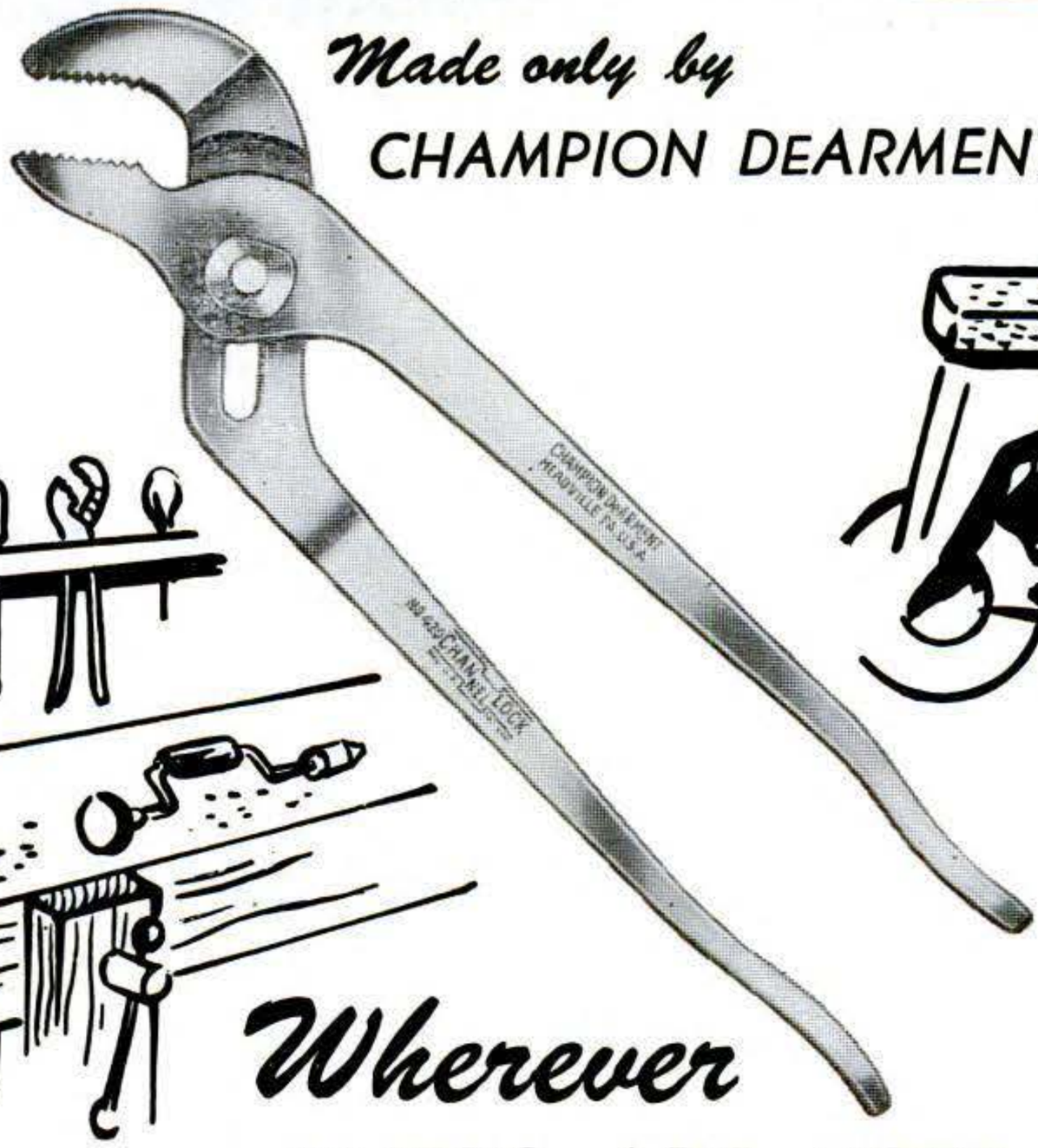

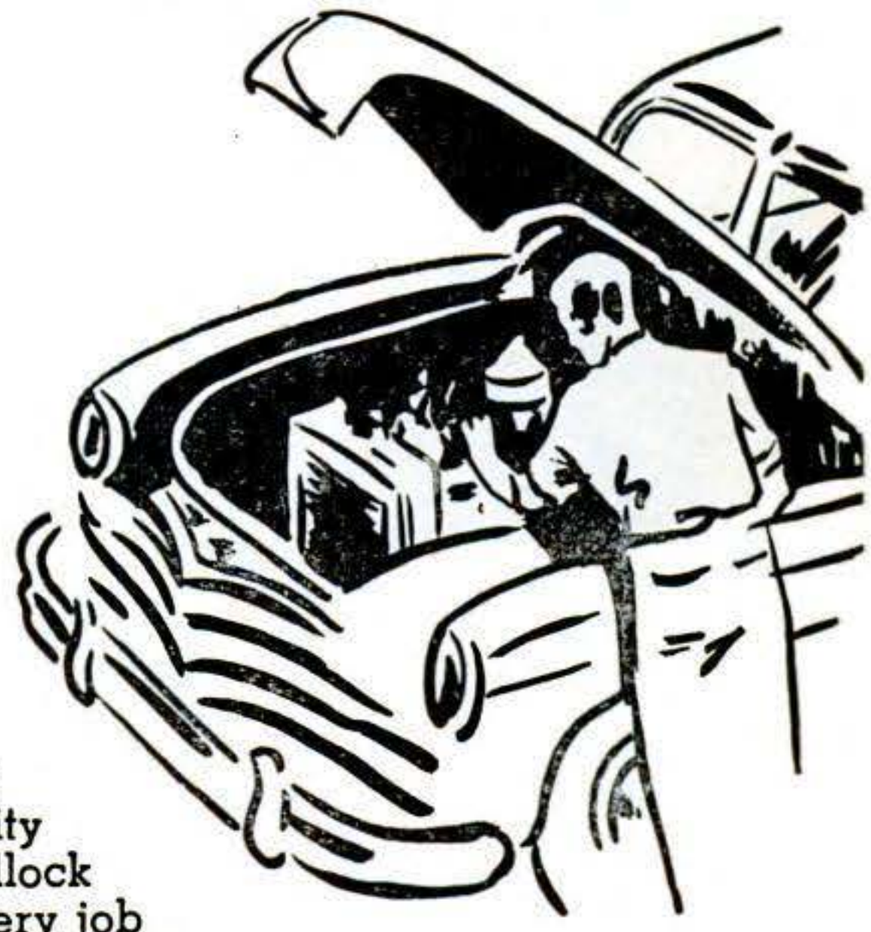

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When Mom or the kids get in a fixin' mood you can bet they'll do a better job when Channellock pliers are handy. Channellocks are easy to use, simple to adjust and—well, darn good pliers. They are made by Champion DeArment who for nearly 3/4 of a century have been making and selling highest quality tools. The next time you're shopping for tools ask to see Channellock pliers. Heft 'em, use 'em, test 'em—then buy 'em. On almost every job requiring tools, you'll find a use for Channellock. And remember, Only Champion DeArment makes Channellock. Send for Catalog D14 Today.

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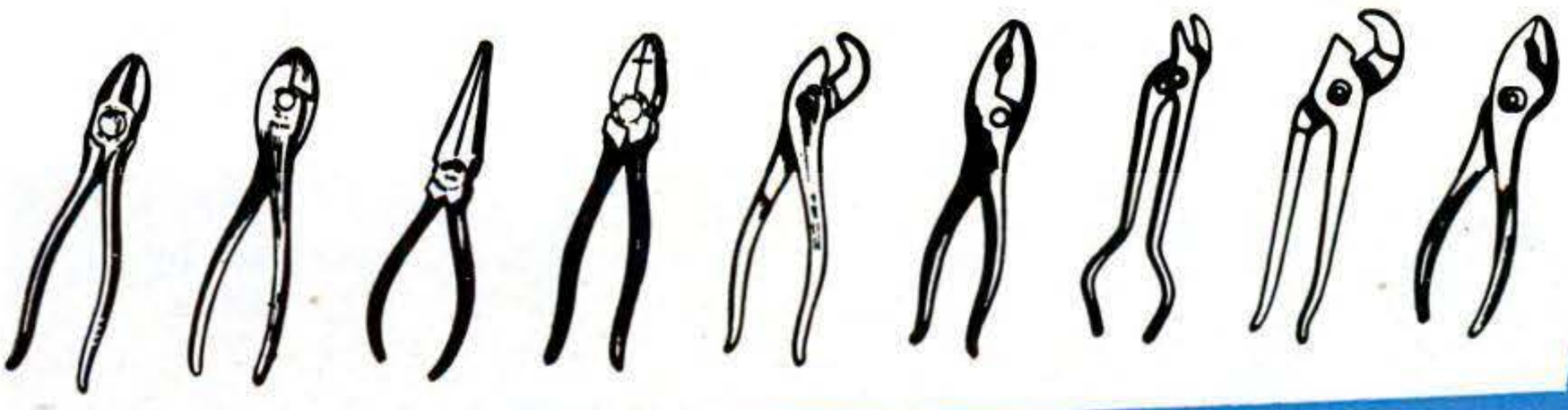

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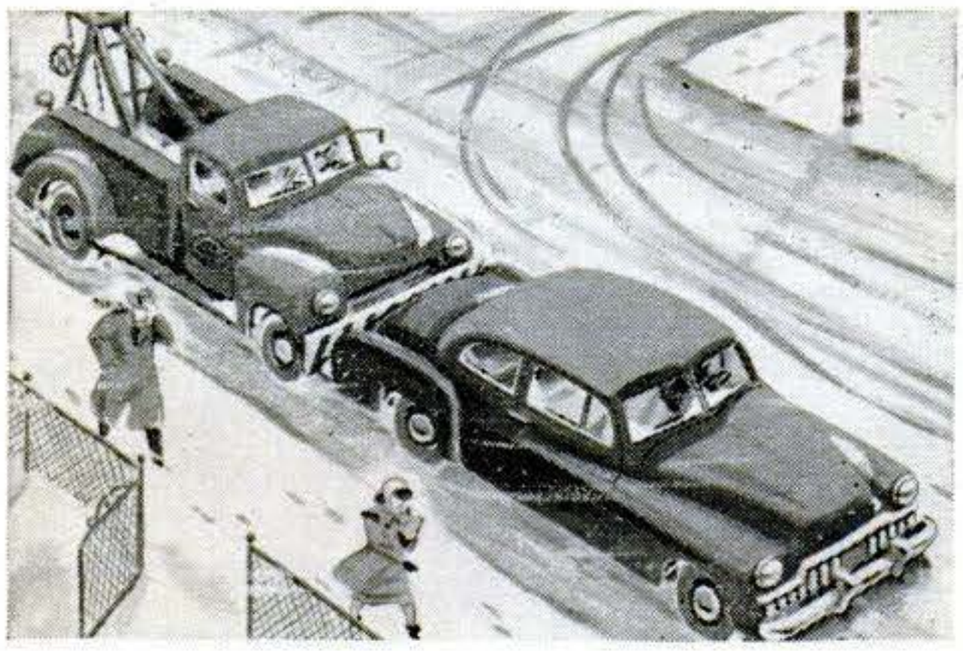

Oil congeals in cold weather, gets stiff, ties up your motor so it can't start.

Casite guarantees Quick Starting in Coldest Weather or Double-Your-Money-Back. Casite retards congealing of oil, lets your motor spin over and start, no matter how cold the weather.

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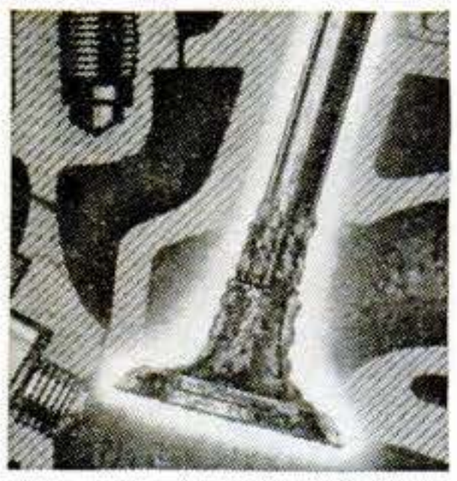

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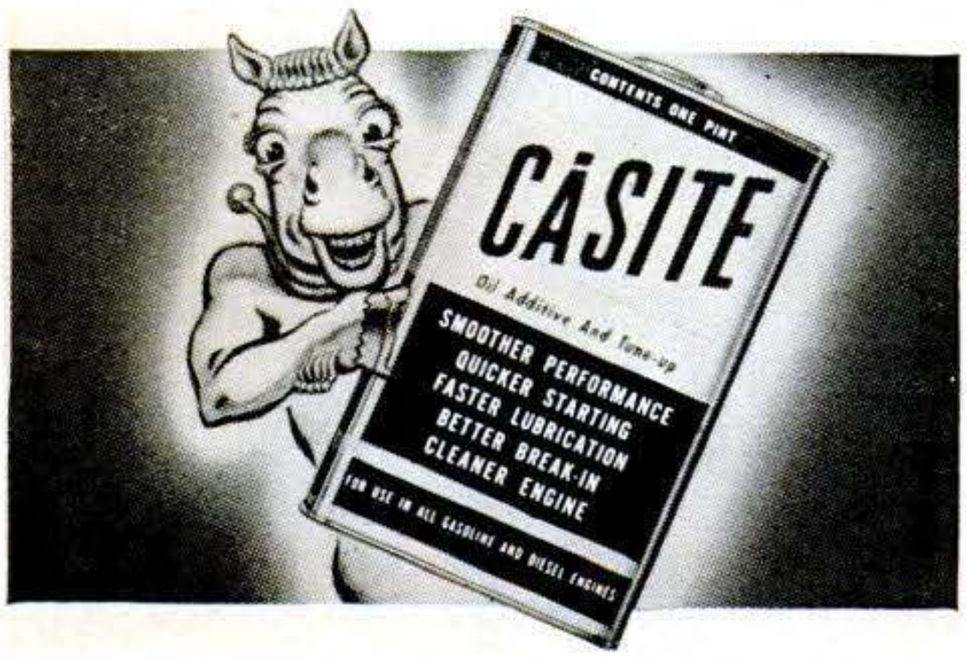
New Car or Old Car . . . Get CASITE for Your Car



Your garage, service station or car-dealer will give you a Casite Treatment—75¢ a pint (95¢ in Canada). You'll get smoother, happier driving for many miles to come. The Casite Corporation, Hastings, Michigan. Casite Division, Hastings Ltd., Toronto.

QUICK STARTING IN COLDEST WEATHER

or Double-Your-Money-Back

tilates stables, powers mechanical barn cleaners, grinds feed, dries hay, fills silos, drives the milking machine, cools and pasturizes the milk--while farm-to-consumer processing and transportation are almost completely mechanized.

■ Cussing the moldboard plow has become the prime parlor game of many non-farmers in recent years, following attacks on that implement by adherents of the book, Plowman's Folly. Tests recently completed at the Geneva (N.Y.) Experiment Station, however, indicate that the moldboard gets better results on yields and soil condition--in the soil there, anyhow--than does disking, rotary tillage, or subsoiling. The tests offset, but do not entirely negate, claims for other types of soil treatment.

■ Newest use of the "wonder drugs" is in canning. Vegetables canned with antibiotics, says the U.S. Dept. of Agriculture, can be sterilized faster at lower temperatures, without pressure cooking. Better flavor is claimed because mild heat is used.

■ Apply science to the usage of farm products (chemurgy) and you have a subject as important to the farmer and the over-all economy as science-in-the-furrow. For instance, add hydrogen to corn sugar, as did Atlas Powder Co. in its new product sorbitol, and a whole huge new corn market is opened up. The substance absorbs water slowly--and holds it. It's useful in protecting against both drying out and sogginess of tobacco, printers' rollers, flexible glues, cork, cosmetics, candy, etc.

■ Tires made from waste of pulp-paper manufacture are reported by Drs. K. A. Kobe and R. T. Romans, of the University of Texas. The new chemical, replacing styrene, is called PADMS. First tests indicate the tires may be superior to present synthetic tires. Now the paper industry is waiting on the synthetic-tire industry to say how big orders will be before building new plants. And tire companies are waiting on pulp men to find out how much PADMS they can get before converting.

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- Will measure the *actual current consumption* of any appliance or utility either A.C. *or* D.C. and will measure it *while the unit is in operation.* The reading will be direct in amperes. The appliance or utility may be plugged directly into the front panel receptacle. A special pair of insulated clip-end leads is included for motors, etc.
- Will measure the actual voltage and indicate whether the current is A.C. or D.C. and if the frequency is 25 cycles or 60 cycles.
- Incorporates a sensitive direct-reading resistance range which will accurately measure all resistances commonly used in electrical appliances, motors, etc. This range will enable continuity checks and tests for shorts and opens.
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- Will test Thermostats under *actual working conditions.*
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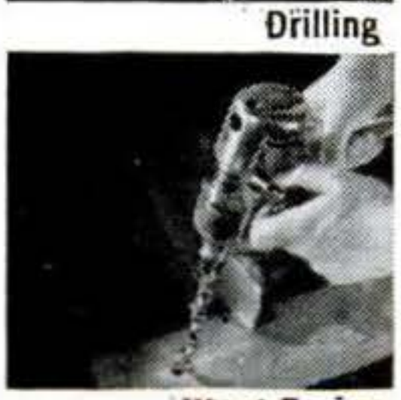
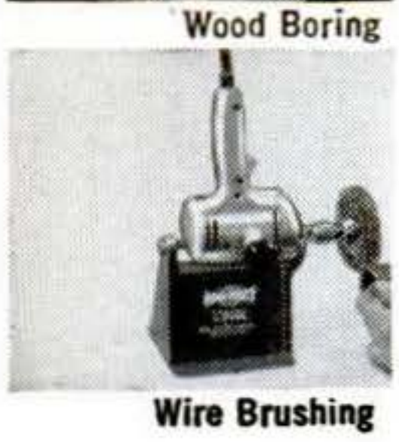

Wood Boring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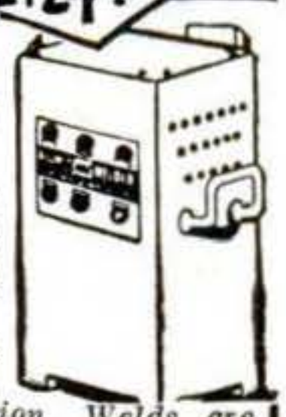

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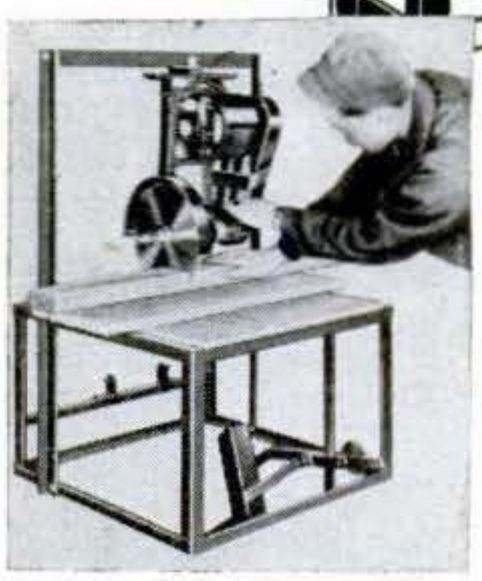

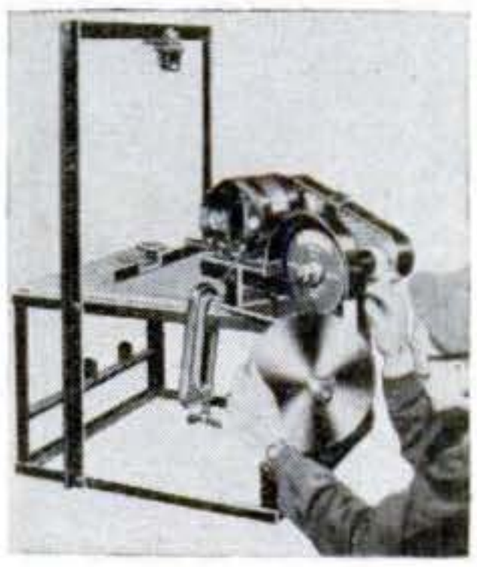

By changing the basic power unit to different locations on the table, the Saw Shop-ette can be used as a swing saw, rip saw, sander, tool grinder, miter saw, metal-cutting saw, and also a tool to sharpen and gum its own blades. Dadoing can also be done on the unit. It is made by the P. T. Hobbs Machinery Co., of Portland, Ore.

The machine is priced at $128 and includes a ¼-hp. motor with cord, a cut-off saw, a rip-saw blade, and a grinding wheel. A ½-hp. motor is available for an extra $12.50.

The commercial-type circular-saw gummer and sharpener takes care of all types of blades from 4" to 20" in diameter.

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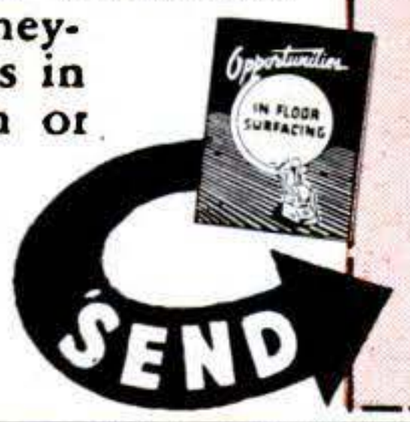
AMERICAN FLOOR MACHINES



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Enclosed find 25c in stamps or coin for booklet "Opportunities in Floor Surfacing", telling me how I can start my own floor sanding business.

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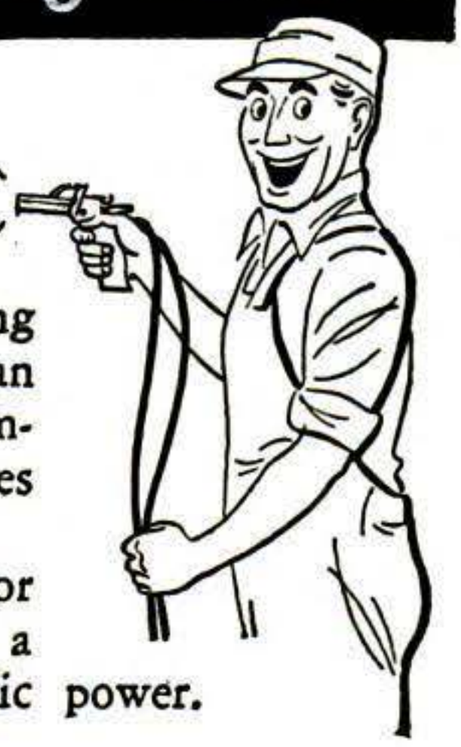

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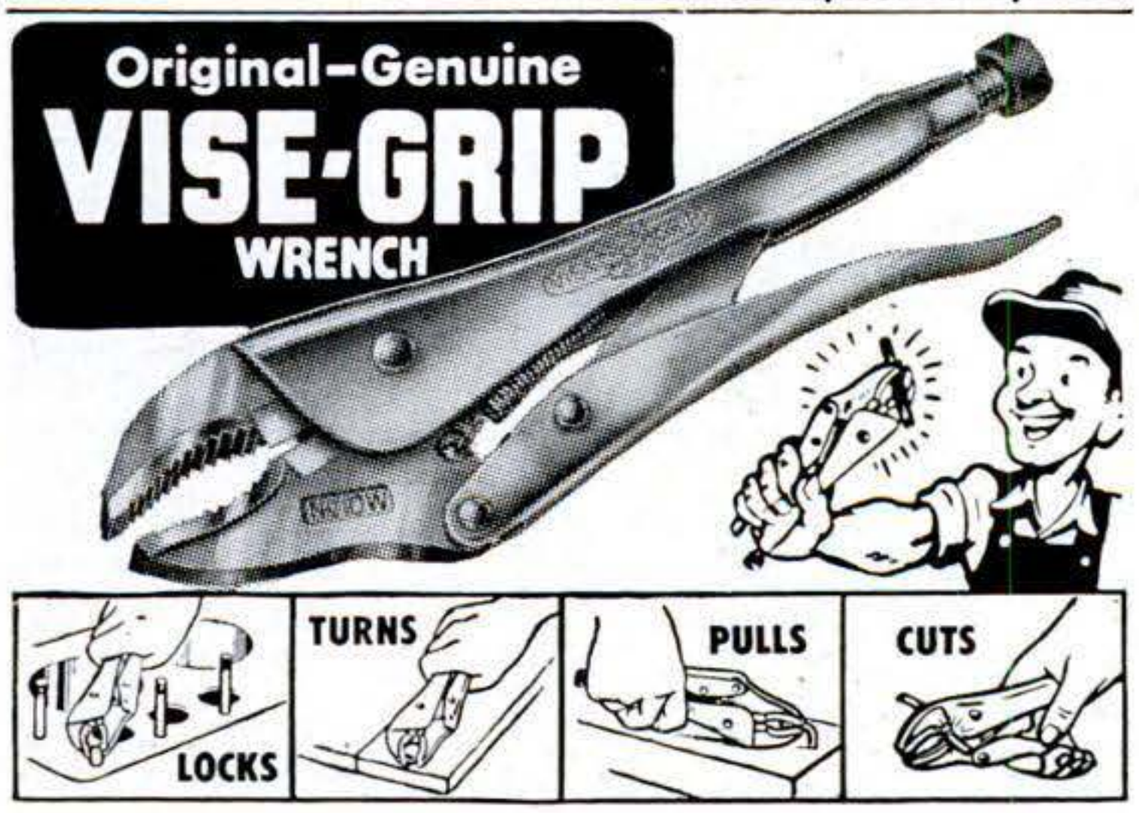

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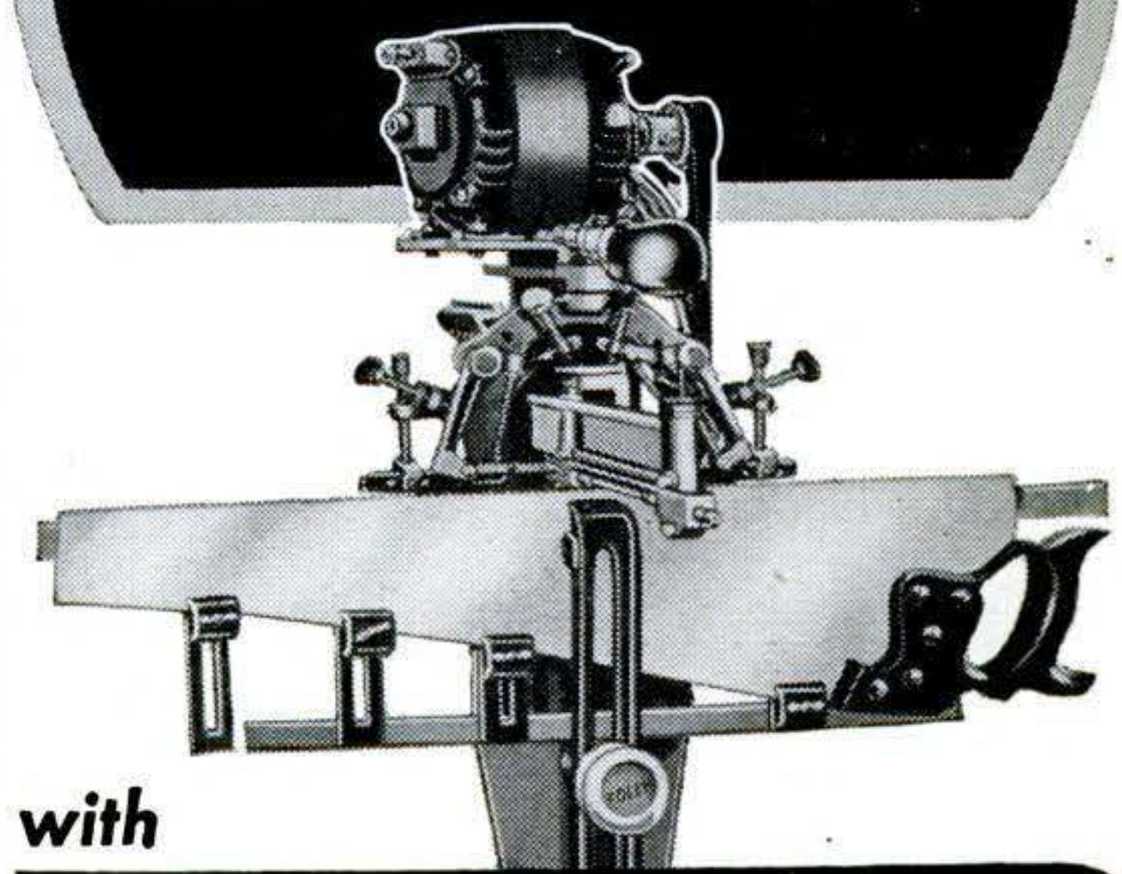

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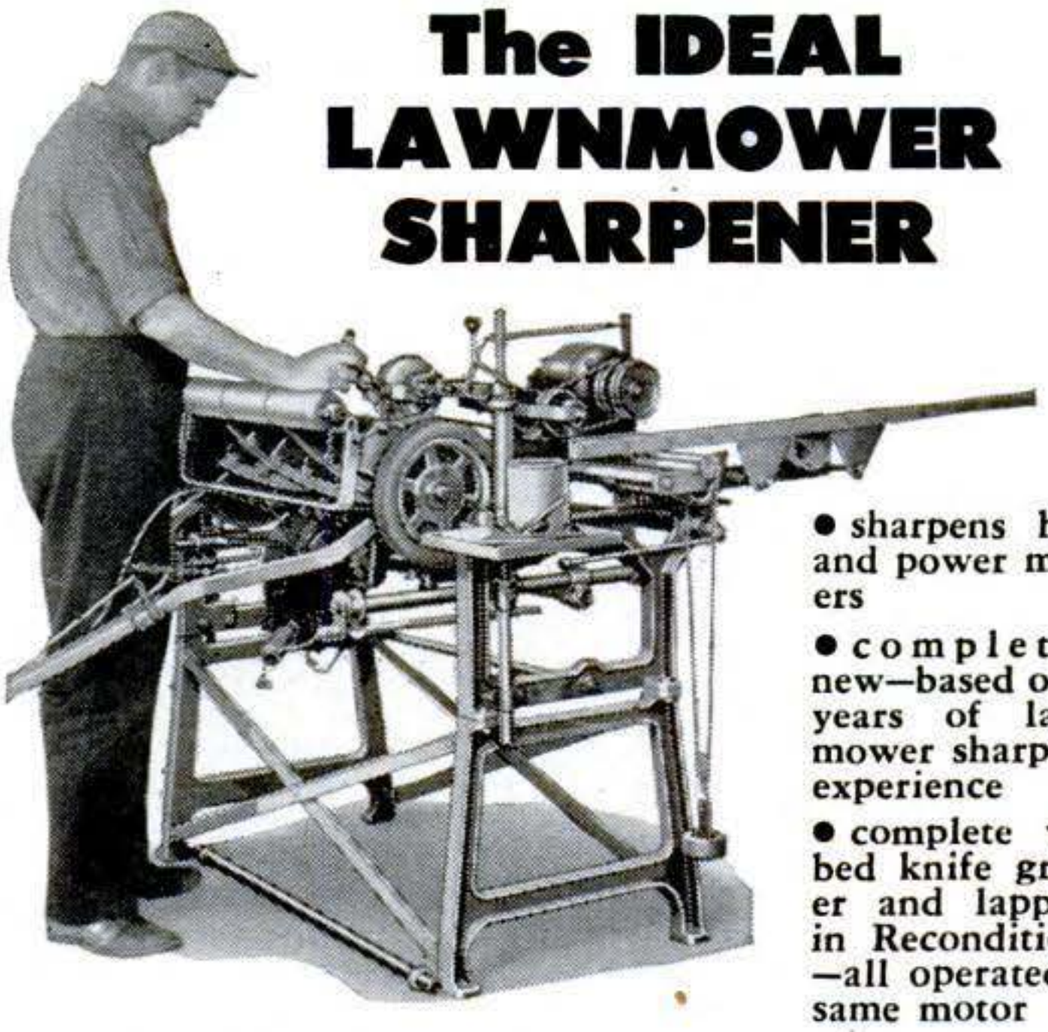

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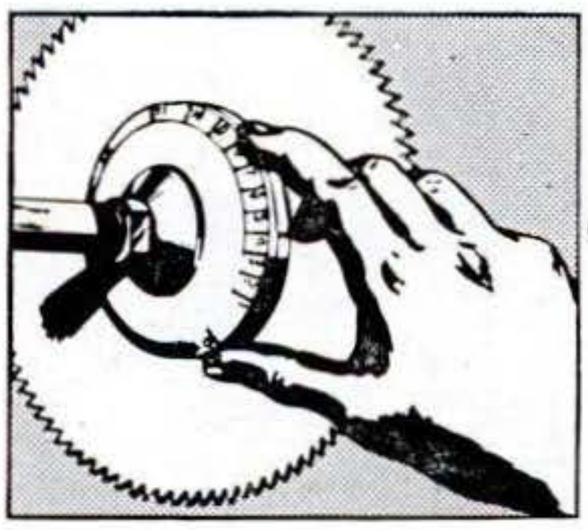

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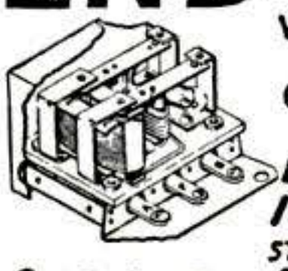

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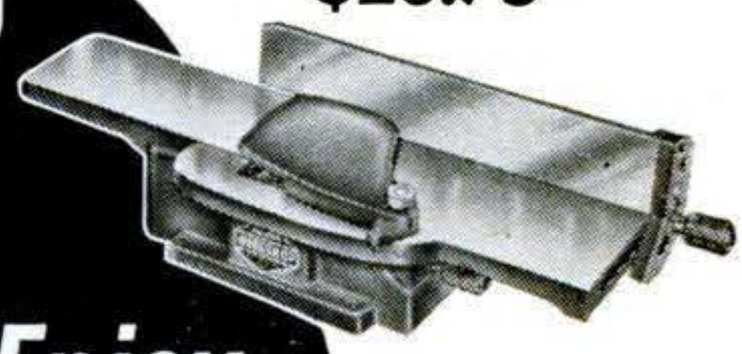

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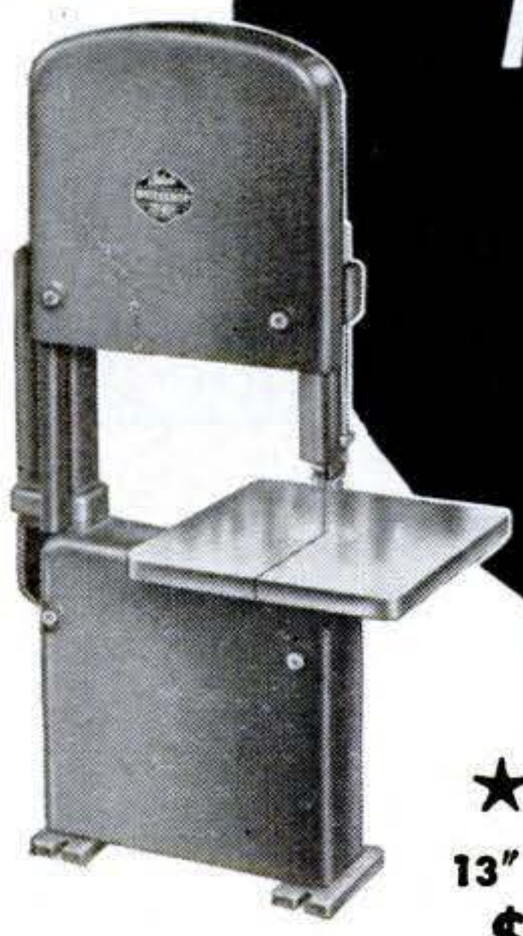

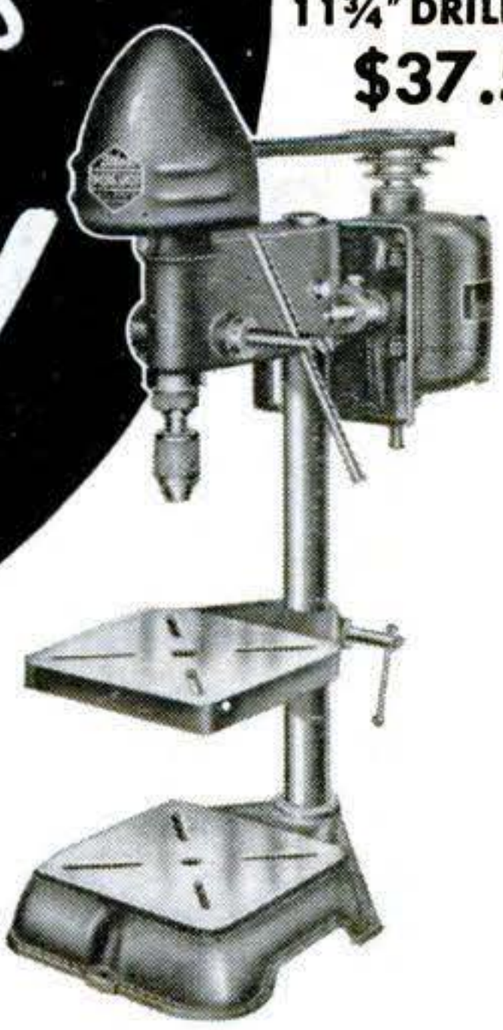

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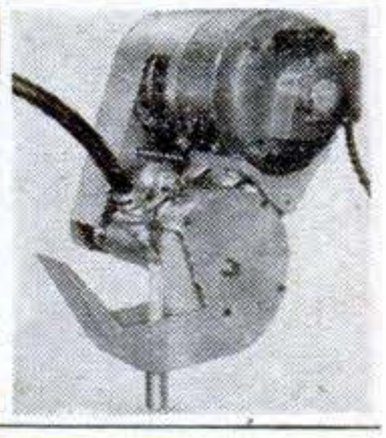

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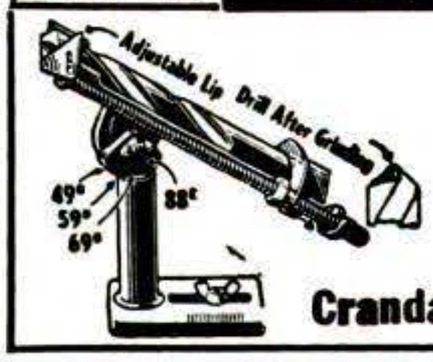

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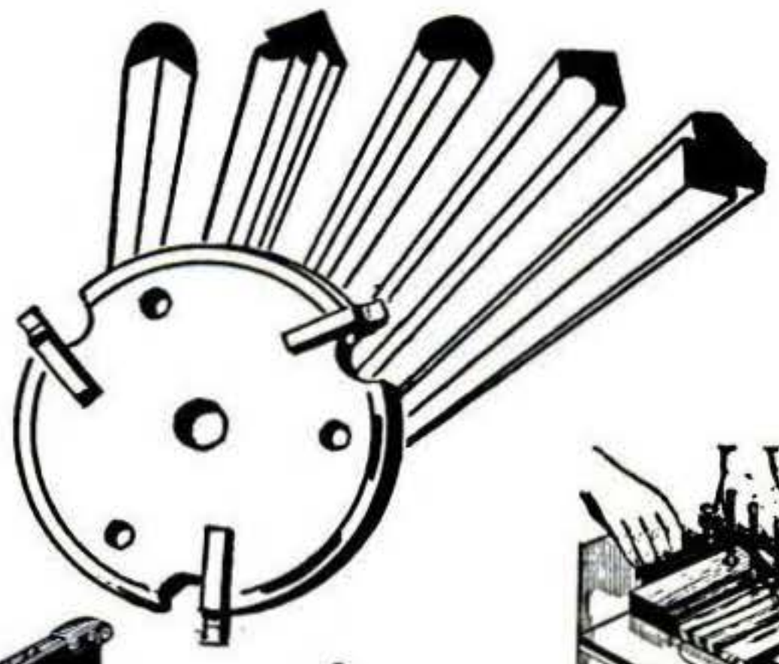

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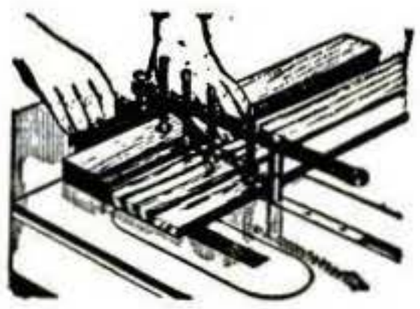
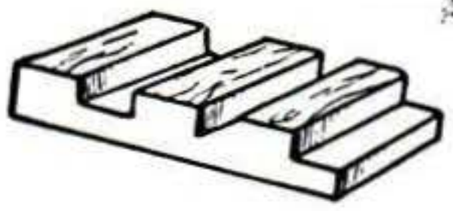


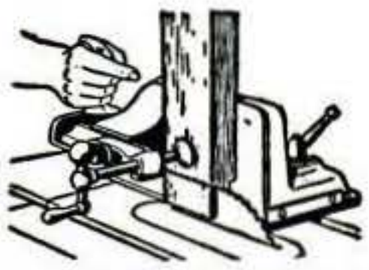
CUT ODD SHAPES SAFELY

Exclusive Delta clamp attachment No. 865 on miter gage holds odd-shaped pieces firmly, safely and accurately!



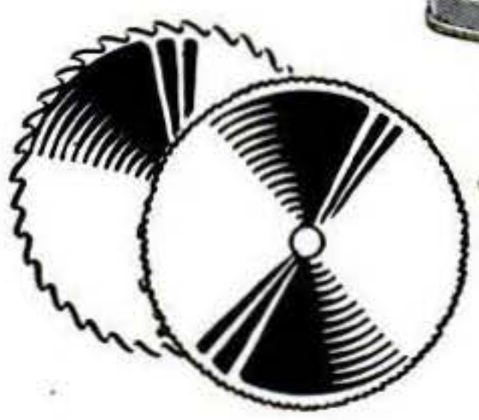
DADO CUTS UNLIMITED

Delta's No 333 Dado Set will straight dado, gain, plough, rabbet, groove, spline cut and do all jobs with and across the wood grain!



CUT TENONS ACCURATELY

Delta Tenoner No. 1172 safely cuts square, parallel tenons in sizes to full capacity of saw for furniture, storm sash, screens, doors, etc.



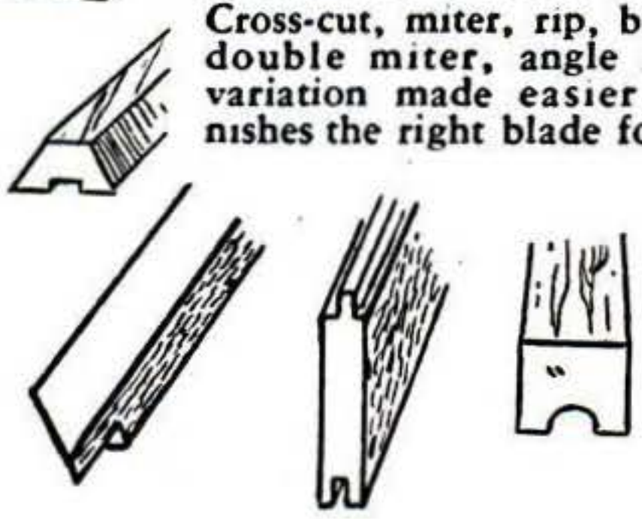
MAKE ALL BASIC SAW CUTS

Cross-cut, miter, rip, bevel, cut-off, double miter, angle rip and any variation made easier Delta furnishes the right blade for every job!

"HOW-TO" HELPS

CUT METALS AND OTHER MATERIALS

Cut thin-wall tubing, solid bars or sheets—cut tile, brick, bakelite, plastics, porcelain and other materials with proper blade or abrasive wheel!



Only DELTA makes a full accessory line — provides ideas and easy-to-follow instructions on how to get the most out of DELTA power tools. Take advantage of the exclusive DELTA "over-all" service — keep your power tools busy — take on new jobs — have fun and make new profits with DELTA power tools and accessories.

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CUTS ONE INCH WOOD 50% FASTER WITH 70% LESS NOISE!

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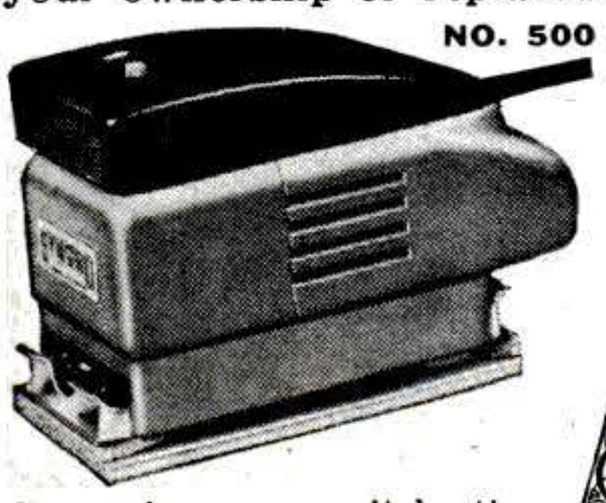
The New 201 JIG SAW

Here's the largest, most powerful jig saw of its kind . . . yet SAFE for children! A "must" for Dad's workshop. Now 70% quieter operation with 50% more power. Cuts any length 1" wood, thin metal, plastic. Precision built to last a lifetime. Portable. Perfect for even apartments! 14,400 Safety Strokes a minute! ENTIRE Saw listed by UL—not just the cord! Built-in Power Unit guaranteed against burn-out all during your ownership or replaced Free! *COMPLETE with BUILT-IN Fractional Horsepower Reactor Type Electric MOTOR, Blades, Cord—only $22.95.*



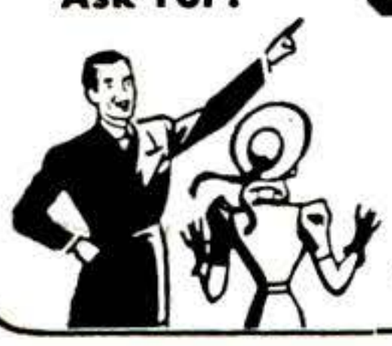
New Improved SYNCRO SANDER POLISHER and MASSAGER

Comparison proves it best! Exclusive Double Arc Motion. For all light sanding, high polish jobs in tight places, corners, etc. Marvelous massager. 240 strokes a second—just guide it. UL-Listed.

COMPLETE with BUILT-IN Fractional Horsepower Reactor Type Electric MOTOR, 10 sandpapers, lamb's wool and fabric pads, $16.95

SYNCRO POWER UNITS GUARANTEED AGAINST BURN-OUT ALL DURING YOUR OWNERSHIP or Replaced FREE!

THAT'S The Name To Ask For!



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Operate on 60 cycle, 110-120 volt, AC only. Buy at hardware, department stores. If none near, send article price, we'll ship POSTPAID.

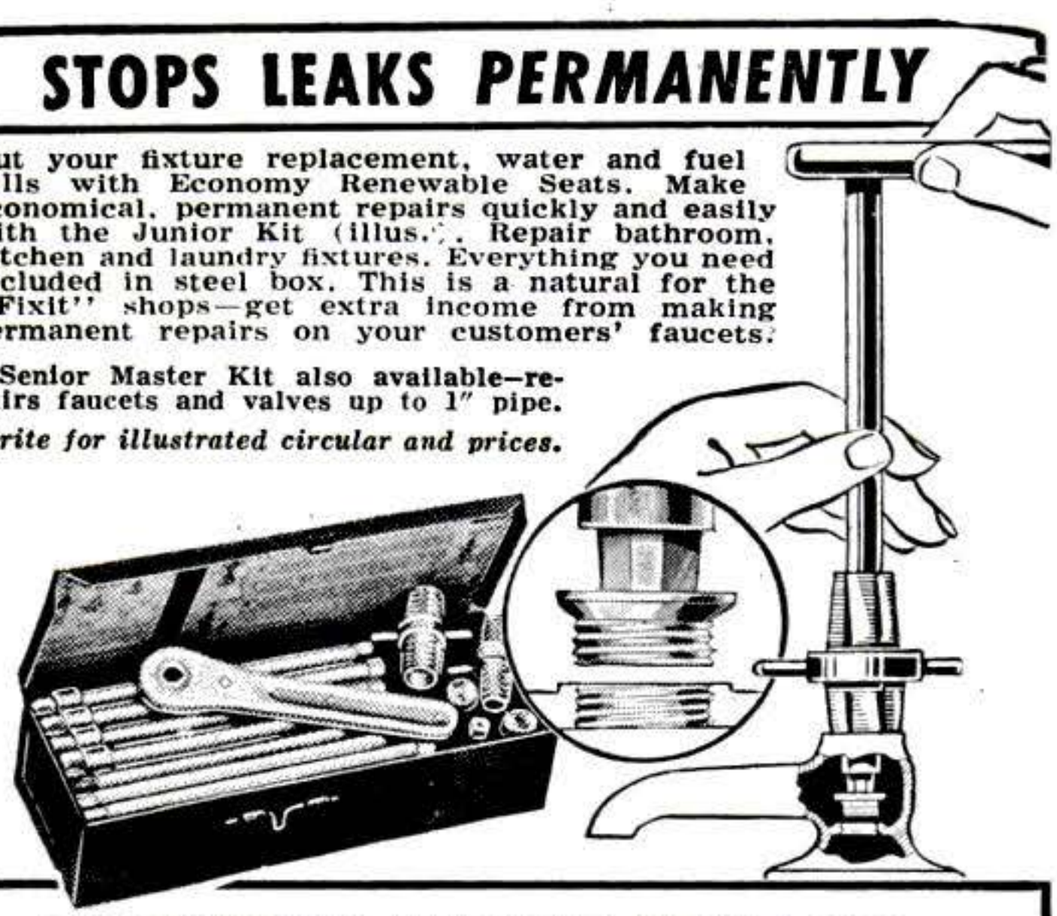
SYNCRO CORPORATION
Dept. G-11, Oxford, Michigan, U.S.A.

STOPS LEAKS *PERMANENTLY*

Cut your fixture replacement, water and fuel bills with Economy Renewable Seats. Make economical, permanent repairs quickly and easily with the Junior Kit (illus.). Repair bathroom, kitchen and laundry fixtures. Everything you need included in steel box. This is a natural for the "Fixit" shops—get extra income from making permanent repairs on your customers' faucets.

Senior Master Kit also available—repairs faucets and valves up to 1" pipe.

Write for illustrated circular and prices.



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SPECIAL OFFER to Hobbyists

ONLY 4.95

Hard Angle Jobs Set-up in 5 Seconds

Save TIME! MONEY! Drill, mill, grind, etc., round, square, irregular pieces at any angle—Quickly—Easily—Accurately with **PALMGREN "HOBB-E" ANGLE VISE** Accurately machined and graduated. 1½" Jaws. 1-Plain, 1-Grooved. Order NOW! Only $4.95. Write for "Hobb-E-Tool" Circular.

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VARIABLE SPEED HYDRAULIC POWER TRANSMISSION

It has Infinate Speeds 0 to 550 Reverse Automatic Overload Protection; Adjustable Torque up to 180 inch pounds. ⅝" Input and Output Shafts. It will handle ¼ to 1½ H.P. Motor. Case measures 7½" long 7" high 6½" wide. VALUE OVER $300. Shipping Wt. 25#. On C.O.D. Orders we require a 10% Deposit.

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SHARPEN CIRCULAR SAWS LIKE AN EXPERT

$6.95

The Super Gadget for Home Workshop
Two simple adjustments. Gets hollow-ground, cross-cut or combination saw blades true and sharp. Fits 6" to 12" blades ½" to 13/16" centers. Includes file, complete instructions. $6.95 postpaid. (C.O.D. postage extra.) Guaranteed—Money back if not satisfied after 10 day trial. **Soon pays for itself.** Order today. Free folder.

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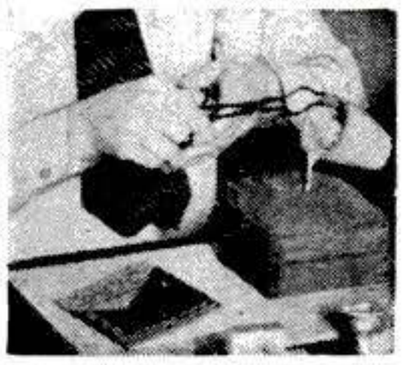

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8 MODELS — $99 up

More cutting—"Tomorrow's BUZZ MASTER Today!" See the de luxe riding model. Nothing else like it. Made by the oldest firm in the business—now in our 47th year. Many special features used only on Ottawa Saws. Write today for FREE DETAILS.

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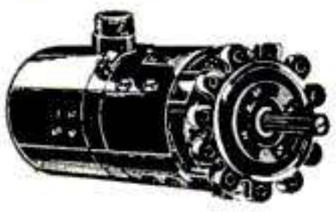
For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.



ITEM #89—Type M-2, rated 50 Amps.—24 Volts. Mfd. by Leece-Neville Co. Shpg wt. 32 lbs. Gov't. Acq. Cost $176.00. F.O.B. Chicago **NOW ONLY 16.50**

ITEM #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse, Gov't. Acq. Cost $300.00. Shpg. wt. 70 lbs. F.O.B. Chicago..... **22.50**

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Each individually packed in wooden box.

ITEM #99—BRAND NEW. Rated 15 Volts at 50 Amps. Use on 12 Volt circuits on trucks, tractors, ships, planes, battery charges, auxiliary lights etc.

Base mounting with 4 bolt holes. 5/8" threaded shaft with keyway. Mfd. by Bendix-Eclipse. Gov't. acq. cost $136.00. Shpg. wt. 53 lbs. F.O.B. Chicago..... **21.50**

HYDRAULIC CONTROL VALVES

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Shpg. wt. 8 lbs. A $38.00 value. post paid **9.95**

(ITEM #24)

ITEM #26. Four-way control valve for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value.....postpaid **12.95**

LOGAN HEAVY DUTY HYDRAULIC PUMP

(ITEM #29)

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has a 3/4" inlet, 1/2" outlet, 3/4" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5 1/2" H x 5 1/2" W. A $105.00 value. FOR ONLY...F.O.B. Chicago **22.50**

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ALL PURPOSE PUMP

(Item #51A)

Ideal For:

- Draining Basements
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- Fuel Oil
- Vacuum Pump—26" for Milking Machines, Lab use, etc.
- Air Compressor—For paint spraying, etc. Delivers 4.5 CFM at 40 PSI with 1725 RPM
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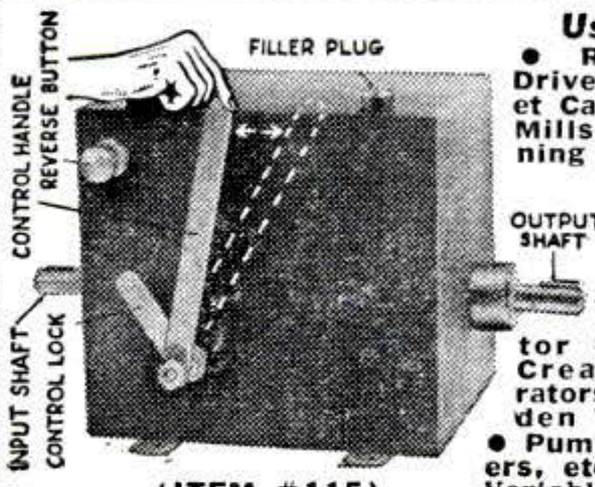
- 4-Ball Bearings—1/2" Shaft—3/8" Ports
- Rotate in either direction
- Rated up to 10 GPM, 120 PSI
- Use with 1/4 HP motor or larger, speeds from 200 to 1800 RPM
- Useful for hundreds of applications in the home, farm and factory
- Built by Pesco—Div. of Borg-Warner. Gov't. acq. cost $45.00. Shpg. wt. 12 lbs.

Free: Complete instructions and performance data with each pump. F.O.B. Chicago. NOW ONLY..... **16.50**

FINGERTIP SPEED CONTROL HYDRAULIC TRANSMISSION



(ITEM #115)

Use For: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps, Blowers, etc.

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P. This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation.

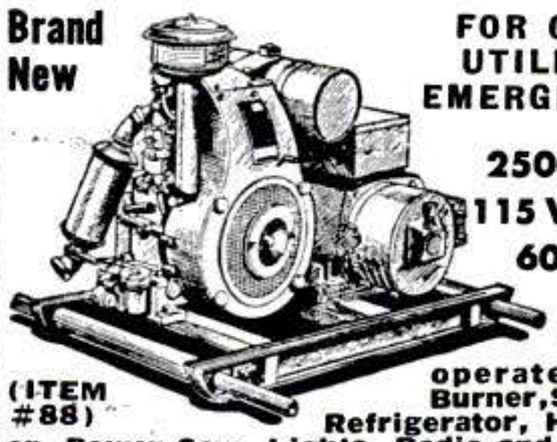
Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 RPM. Overall dimensions, 7 1/2"x7 1/2"x11 1/2".

Gov't acquisition cost, $428.00. Shipping weight 26 lbs. Complete with 2 qts. of oil and full instructions.....Postpaid **54.50**

AUXILIARY ELECTRIC A.C.

GENERATING PLANT

Brand New



(ITEM #88)

FOR GENERAL UTILITY AND EMERGENCY USE

2500 WATTS-115 VOLTS A.C. 60 CYCLES

Plenty of current to operate your: Oil Burner, Sump Pump, Refrigerator, Home Freezer, Power Saw, Lights, Radio and Television, Home Water System Pumps.

Complete integrated heavy duty electric power plant, Signal Corps Model PE-75, driven by Briggs & Stratton, one cylinder 6 1/2 H.P. Model ZZ, 4-cycle engine with killer button, oil bath air cleaner, governor, muffler, starting rope, and radio interference filter.

The self-excited Leland generator is rated 2500 Watts, 115 Volts, 60 Cycle A.C. single phase, belt driven, with guard and duplex receptacle.

When generator is not in use, you can use the engine separately to power other equipment.

Mounted on adjustable steel skids, notched for carrying poles. Net wt. 310 lbs. Shpg. wt. 440 lbs. Dimen. 36"x-19 1/2"x24". 12 month guarantee. $726.00 value...NOW F.O.B. Chicago..... **295.00**

FREE: 1951 CATALOG

New 48-page catalog listing Brand New War Surplus bargains including Aircraft Quality hydraulics, A.C. generators, pumps, welders, tanks, and many, many others. You save on everything! Write for yours today!

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HYDRAULIC CYLINDERS • AIR or OIL

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #70—Purolator hydraulic oil filter. Permanent element type. 3/8" female pipe thread ports. Capacity, 16 gallons per minute. A $13.00 value. Now.. Postpaid **4.95**

ITEM #4—All steel double action hydraulic cylinder, 1 1/8" bore, 2 7/8" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. **Postpaid** **4.95**

ITEM #33C—Double action hydraulic cylinder. 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. **Postpaid**..... **8.95**

ITEM #32—Double action. 1 1/2" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value. **Postpaid**..... **10.95**

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base and end of shaft. Overall length closed 12 1/2". Has 3/4" stainless steel shaft, uses 1/4" tubing fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Wt. 7 lbs. **Postpaid** **12.50**

ITEM #16C—Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 P.S.I. line pressure. Weight 8 lbs. $55.00 value Now Only.....**Postpaid** **16.95**

ITEM #103—Double acting hydraulic cylinder, 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 P.S.I. line pressure. 1 1/4" diam. shaft. 3/8" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs. F.O.B. Chicago **21.50**

ITEM #31C—Double action hydraulic cylinder, 3 1/2" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1 1/8" diameter piston rod. Clevis mounting at base and shaft. 19 1/2" overall length closed. Will lift 9625 lbs. using 1000 P.S.I from Logan Heavy Duty Hydraulic Pump. Uses 3/8" tubing fittings. Value $102.00. Shpg. wt. 11 lbs. F.O.B. Chicago **22.50**

ITEM #6A—Double action hydraulic cylinder, 3" bore, 25" stroke, will lift 7070 lbs. with 1000 P.S.I. line pressure. Steel barrel, 1 1/2" stainless steel shaft. Gov't. acq. cost, $176.00. Shpg. wt. 26 lbs. F.O.B. Chicago..... **28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. line pressure is 12,560 lbs. Shpg. wt. 30 lbs. AN EXCELLENT BUY. F.O.B. Chicago..... **32.50**

NEW! STATIONARY OR PORTABLE

D.C. ARC WELDER

250 AMPS. MODEL 252

(ITEM #65)

(Item #65)

FOR ANY WELDING JOB, LIGHT OR HEAVY

Only one or two jobs will pay for entire welder.

Stop Costly Repair Bills, Weld It Yourself and Save

Designed for many years of trouble-free service. This precision engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor, a 7 1/2 HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley).

Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Shipping wt. 107 lbs. F.O.B. Chicago..... **99.50**

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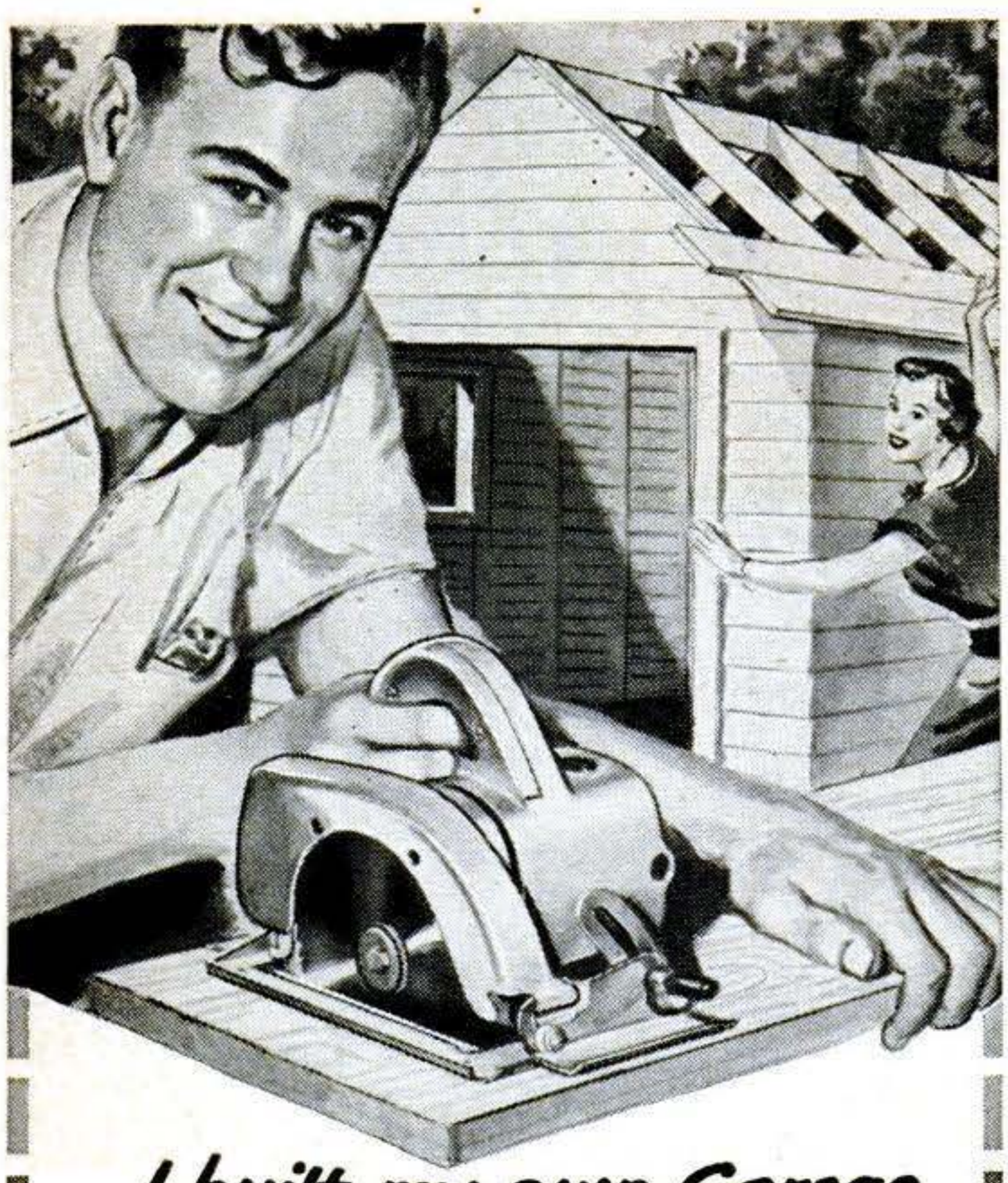
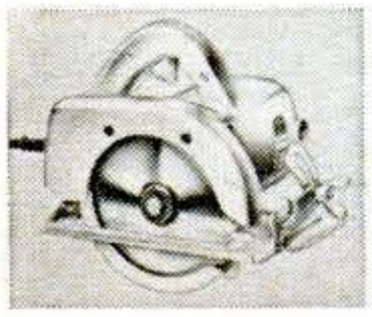


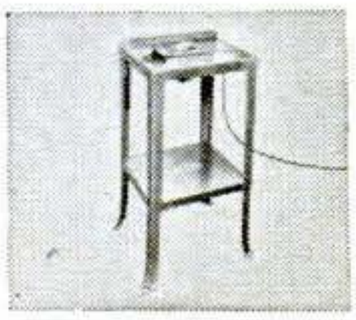
I built my own Garage on weekends with SKIL Home Shop Tools

A new porch, an attic room, needed repairs, are easy and economical with SKIL Home Shop Tools!

No project is too big or difficult for *you* with SKIL Home Shop Tools to help. SKIL Home Shop Saws cut wood and wallboard *fast and true*. Safe . . . easy-to-use even by beginners and so inexpensive they pay for themselves on a single job.



SKIL Home Shop 6 inch Saw
Bevel cuts! Adjustable—3/4" to 1 7/8"
Perfect for repairs, remodeling, hobbies!
Model 520 $59.50



SKIL Home Shop 8 1/4 inch Saw
Bevel-cuts! Adjustable!
Rips, cross-cuts, bevel-cuts 2 x 4's, 2 x 6's, 2 x 8's.
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SKIL Home Shop Saw Table
Converts SKIL Home Shop Saw to a tilting arbor saw. Sturdy, accurate, economical.
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Ask your dealer about these other SKIL Home Shop Tools
• *1/4 and 1/2 inch Drills* • *Sander-Polisher* • *Bench Stands* • *Drill Kits* • *2 1/4" Belt Sander* • *SKIL Trimmer*

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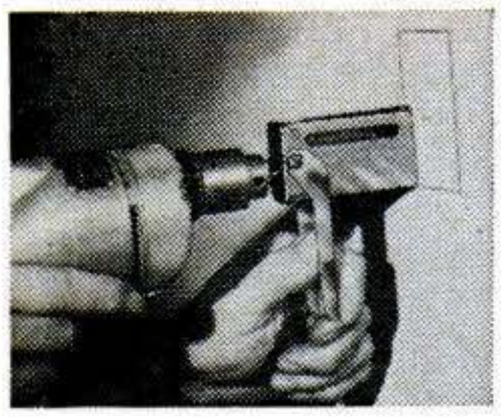

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"The Mighty Little Midget"

BULL HACK SAW

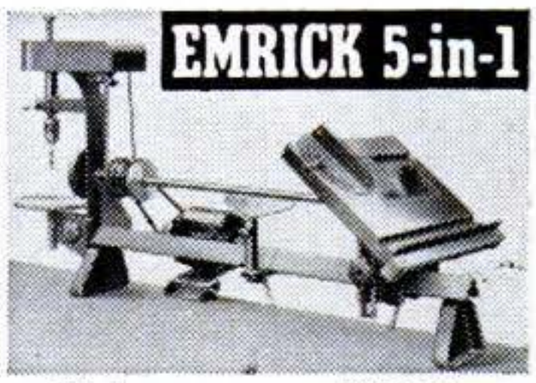
ONLY $4.95

Fits any 1/4" electric drill or drill press. Weighs only 11 ozs.; small in size—easy to carry, easy to use. 2-to-1 ratio of drill speed to saw speed for extra power! No gears, no bearings, nothing to wear out. Full chip clearance on any wood, metal or plastic stock up to 3/4". Powerful, portable, pocket-size—a must for every home craftsman, only $4.95.
LIFETIME GUARANTEE: At any time, we guarantee to put this tool in perfect working order for a handling charge of 75c.

BERTRUM E. ENGINEERING & SUPPLY CO.
3121 Main Street **Kansas City, Mo.**

Saw, Drill & Grind

without stopping, lifting machine or changing set-ups; only one change for lathe work and sanding. No heavy lifting. Basic Emrick 5-in-1 Machine still only $39.95. **10-day Free trial; Money-Back Guarantee.** Write for FREE Catalog of entire line.



EMRICK, INC., 211 Clinton, Kalamazoo, Michigan

HANDY CALCULATOR FOR WOODWORKERS.. ONLY 10c

Just set dial, quickly solves countless problems. Converts linear to board feet, compares workability of various woods, shows bit sizes, nail specifications. Also tool sharpening tips, etc. 6" diameter heavily varnished cardboard. Send 10c to Greenlee Tool Co. 2121 Columbia Av., Rockford, Ill.

SAW SHARPENER

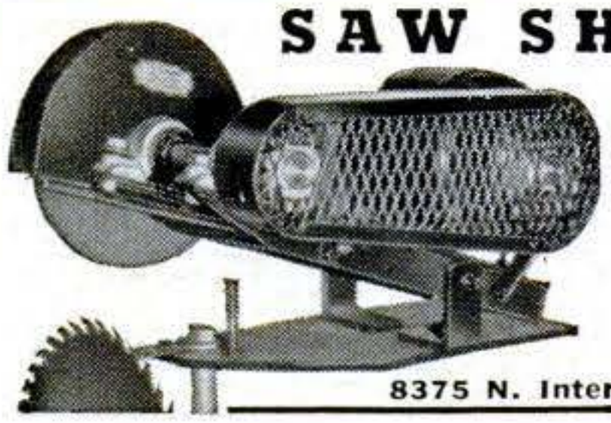


Table model, gums and sharpens rip saws, combination saws & cut-off saws. Ideal for "Skilsaw" blades. Cap. 4" to 20" diam. Complete with 1/4 h.p. motor & 1 grinding wheel & cord—$64 f.o.b. Portland. Shipping weight, 63#. SEND FOR FREE LITERATURE.

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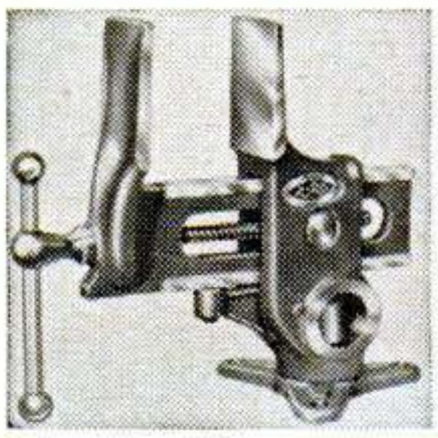

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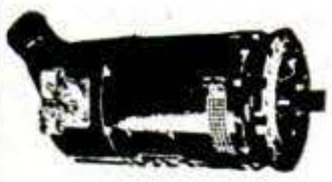

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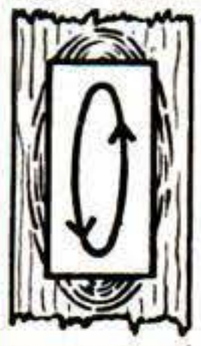
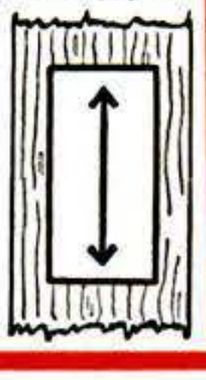


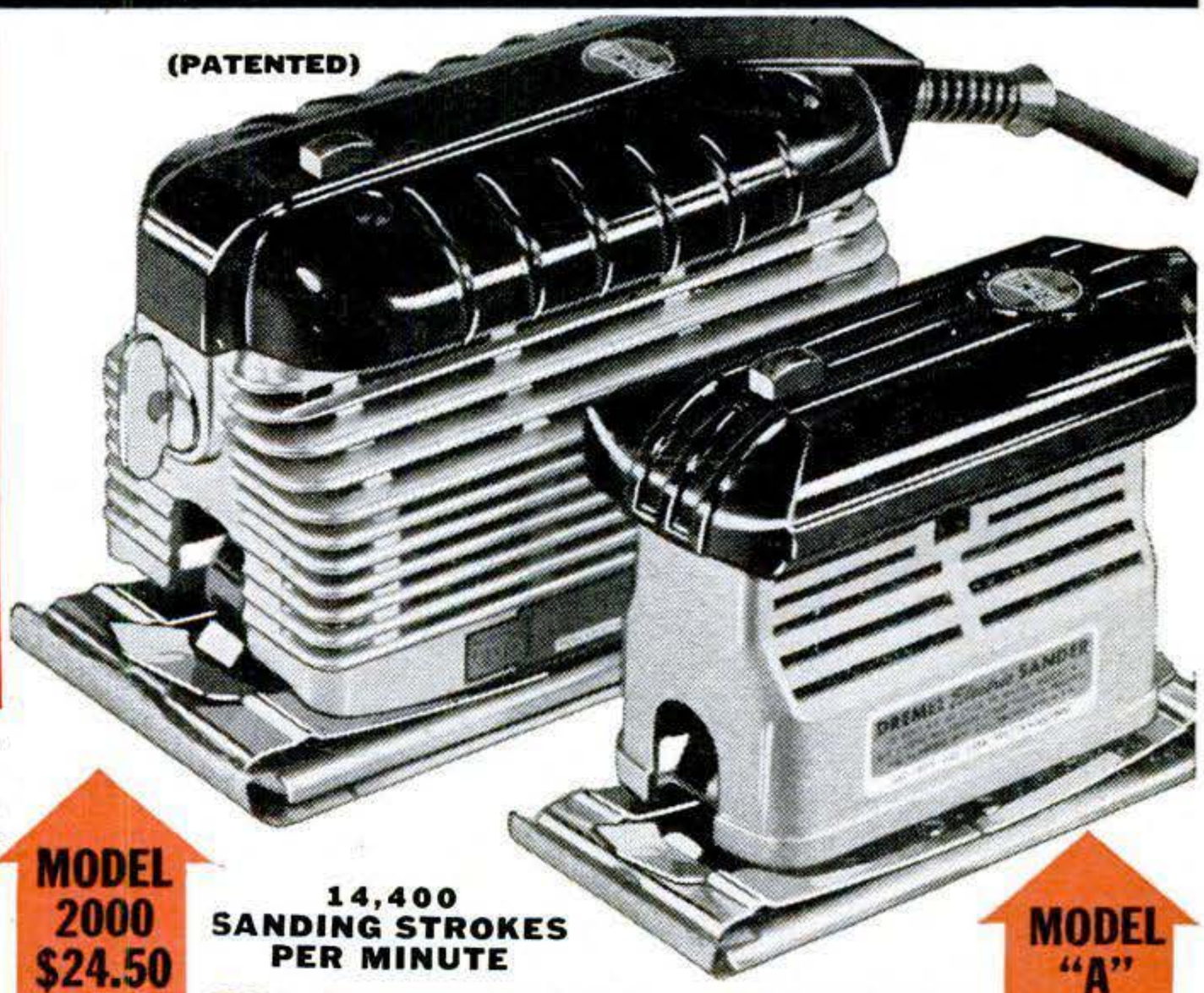
ORBITAL Action Partial cross-grain motion

ARC Action 100% cross-grain motion

ROTARY Action About 50% cross-grain motion



DREMEL Reciprocal Action 100% **WITH THE GRAIN** motion for scratch-free finishes



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MODEL 2000 $24.50

MODEL "A" $14.85

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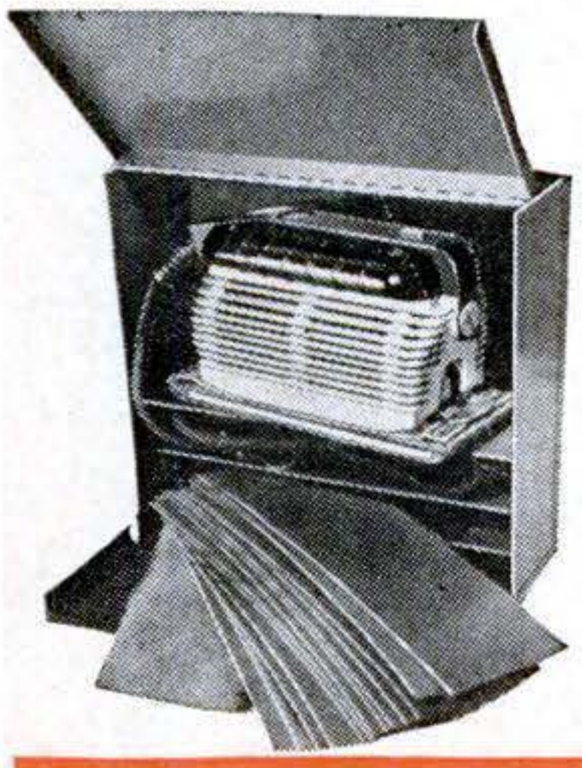

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—Easy portability assured with this all steel storage case. Price also includes 25 assorted sheets abrasive paper, and a sheepskin polishing pad.

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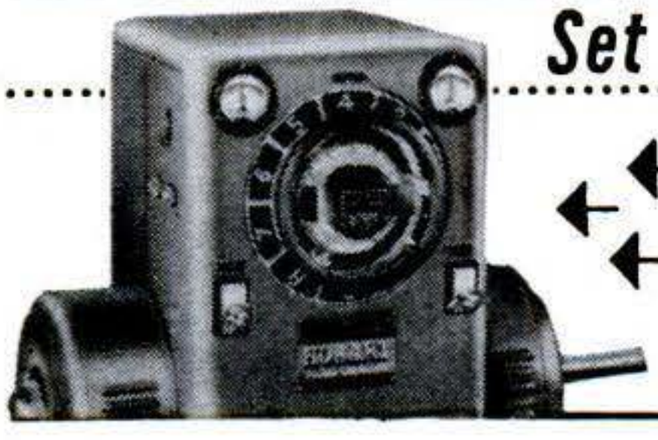

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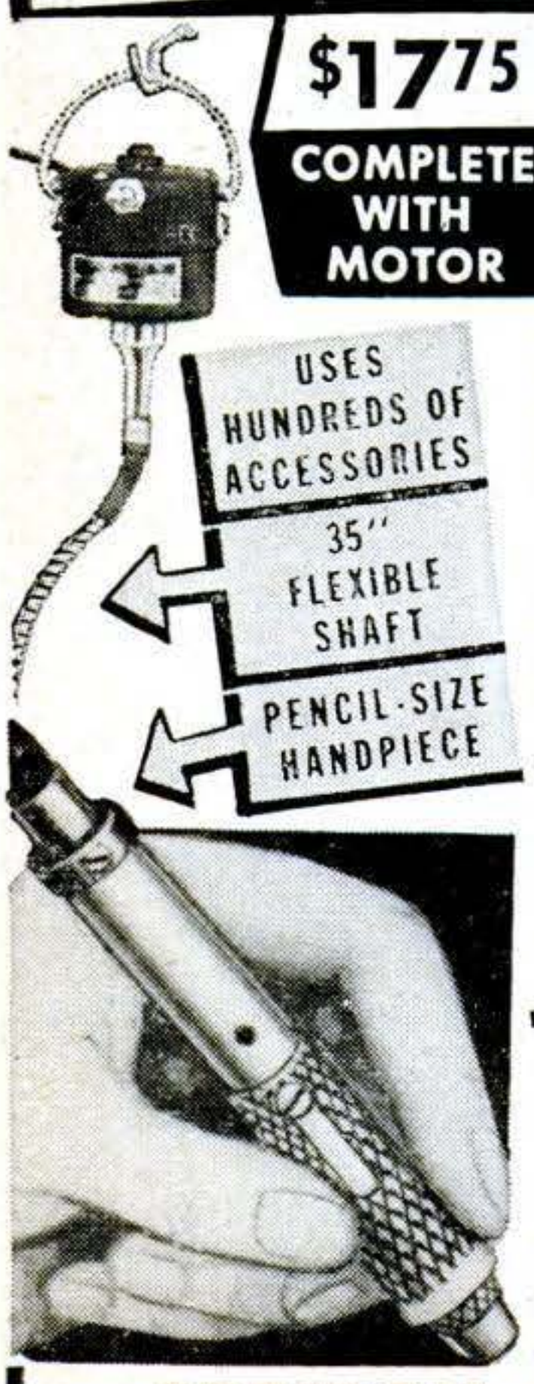

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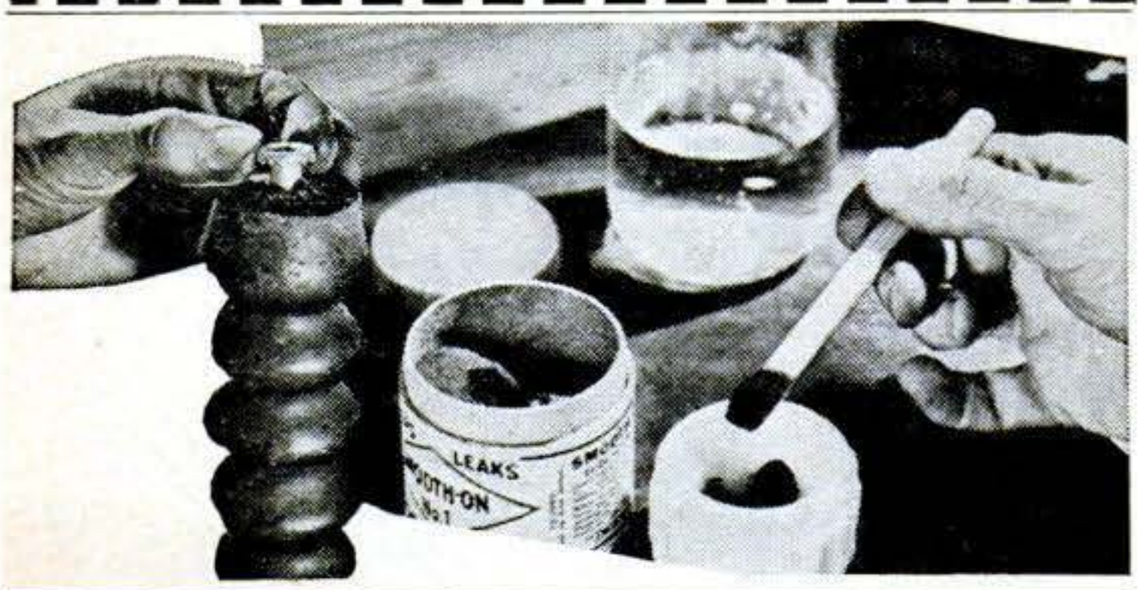

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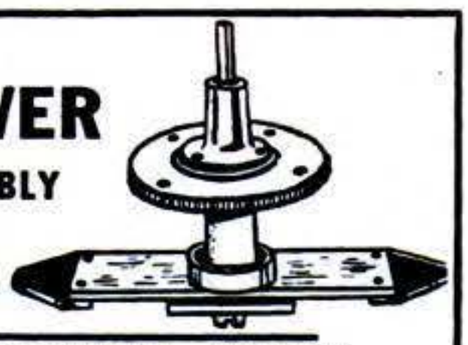

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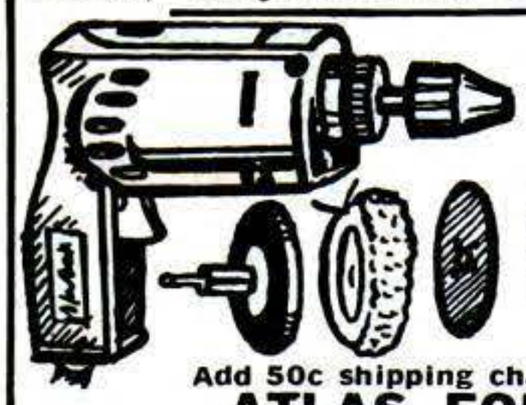

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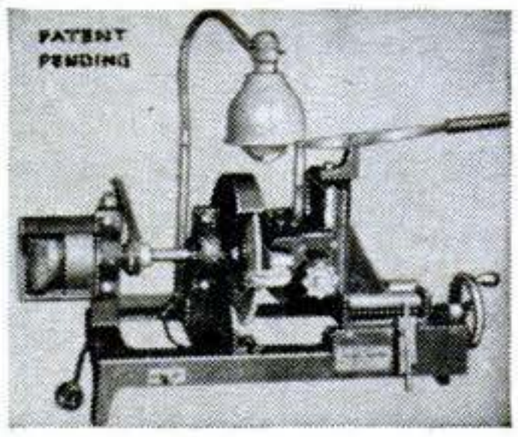

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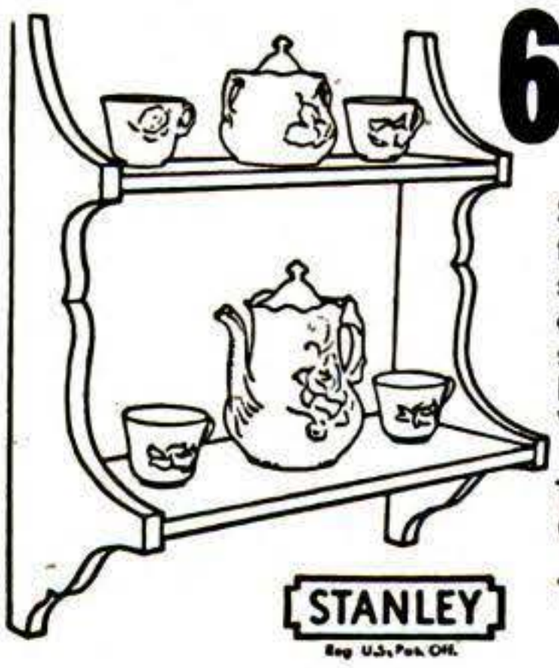

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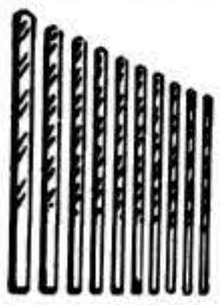

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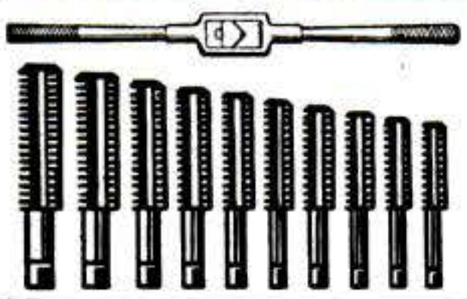

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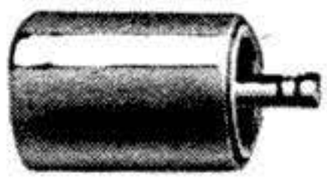

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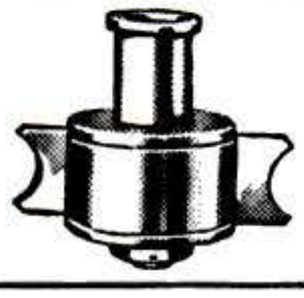

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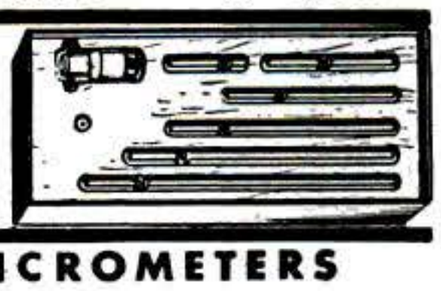

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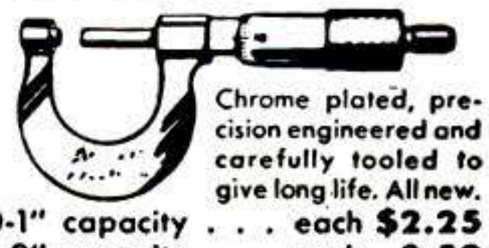

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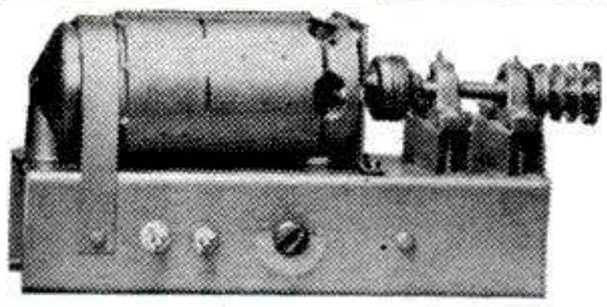

Now you can make your own welder using any aircraft generator and save many dollars. Only a pair of pliers and a few minutes are needed to assemble this kit into a sturdy welder giving you many years of useful service. Satisfaction guaranteed.

HERE'S WHAT YOU GET: No. AW5-Kit includes Special Hook-up Leads, Amperage control with leads, Mounting Plate, Pillow Bearings, Bearing Supports, Shaft Extension, Flexible Coupling splined to fit your generator, Triple Groove "B" Type Pulley. Plan included. No. AW5-Kit Complete **$39.95**

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(R-1 Generator Cost Gov't. approx. $400.00)

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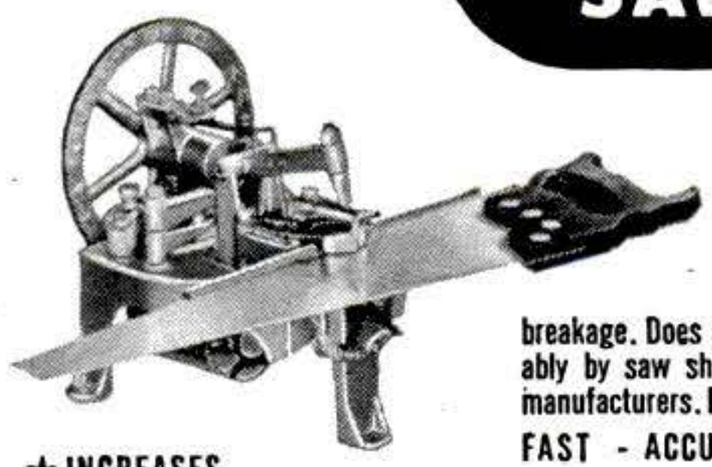

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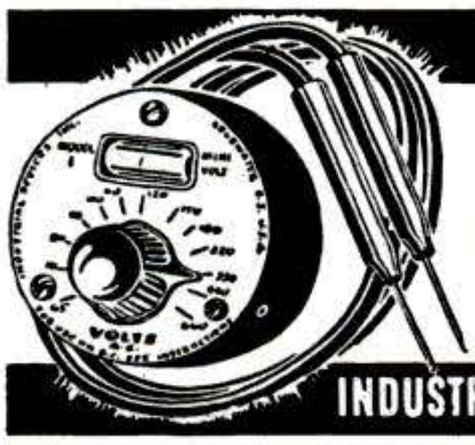

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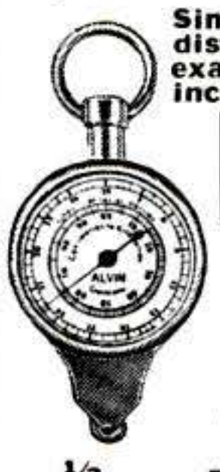

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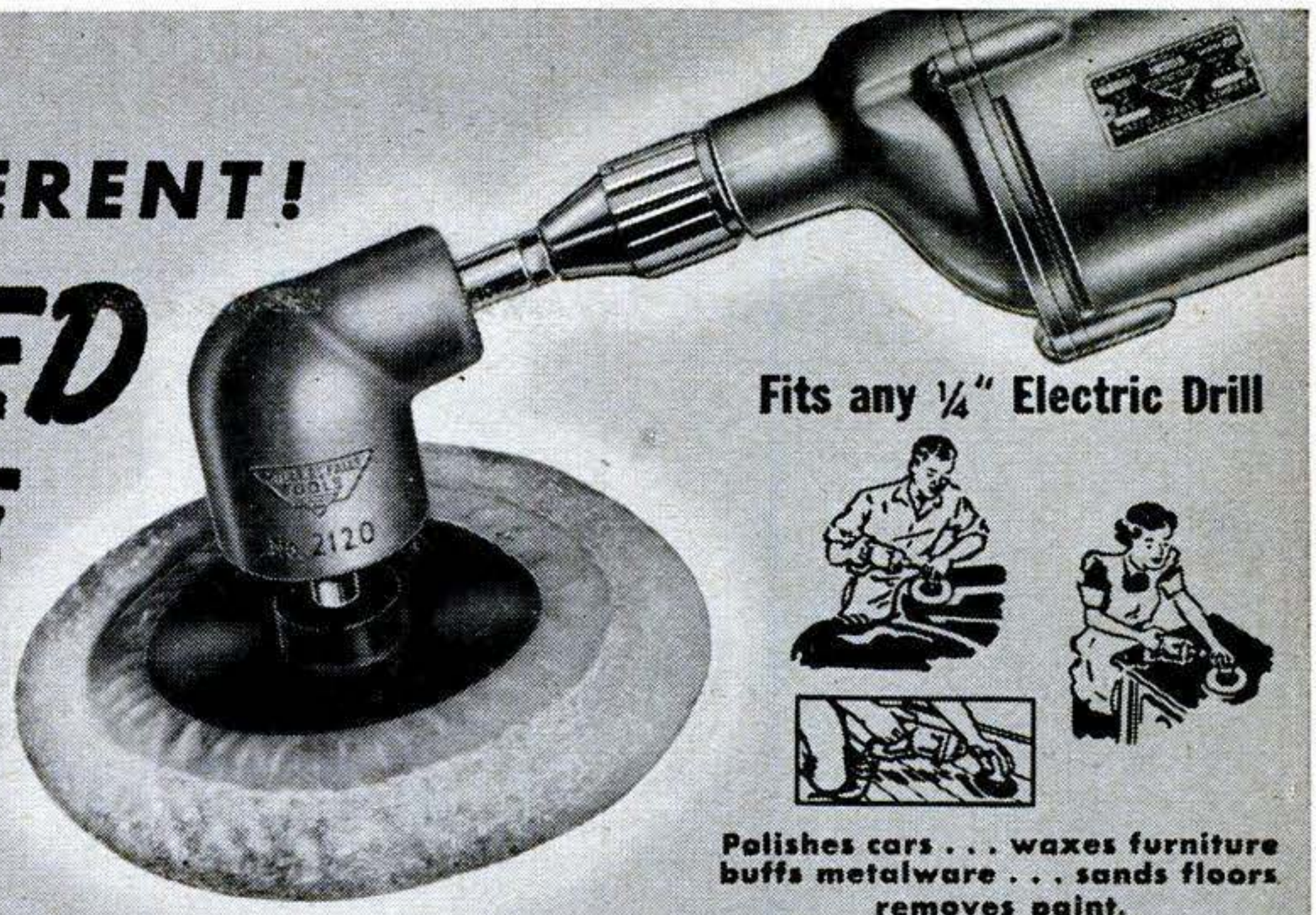

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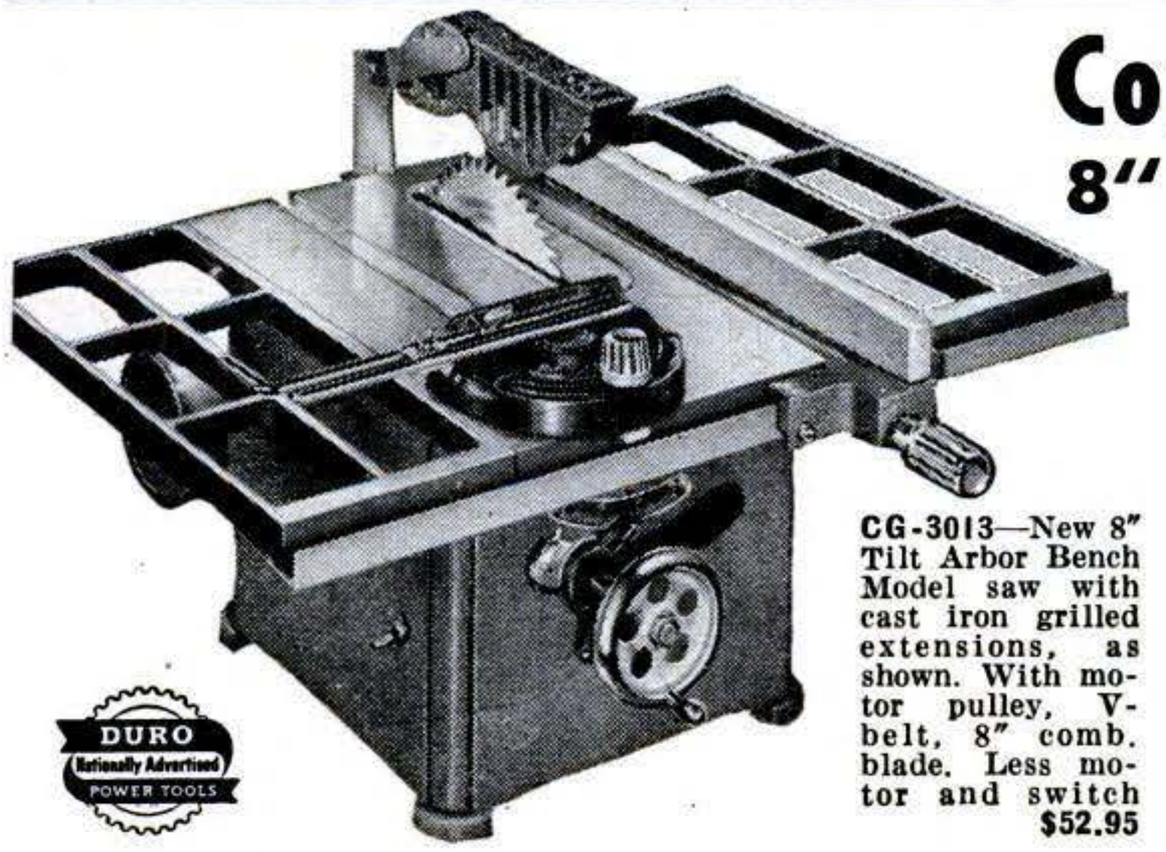

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$46.50

C-3013—New 8" Tilt Arbor Bench Model saw. With motor pulley, V-belt and 8" comb. blade. Less extensions, switch and motor. **$46.50** retail.

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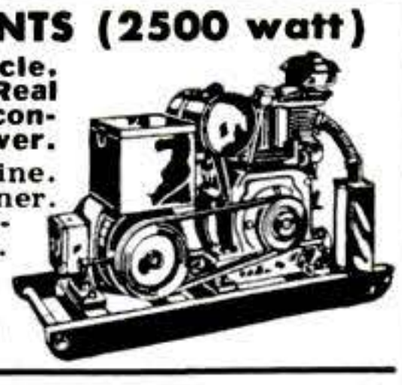

New 110-volt, 60-cycle, Army's finest plant. Real buy. Ideal for farmers, contractors, camps, city power.

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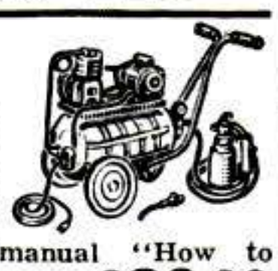

Build portable hi-pressure (up to 150 lbs.) air unit. Basic kit consists best 1-cyl. piston compressor, stainless 12"x24" tank, 160-lb. gauge, genuine Brown paint spray gun, dust blow gun, tire chuck, 15' hose, fittings and manual "How to Build." Guaranteed. Brand new..... **$36.90**

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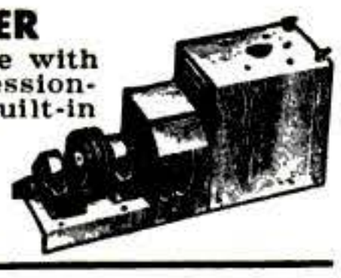
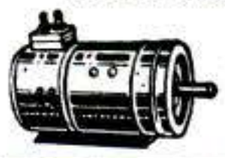


0-250 amps. Easy to drive with tractor, engine, etc. Professional outfit. Ready to use. Built-in controls, reactor..... **$89.90**

- Unit with G.E. helmet, rod holders, rods, cables, clamps, etc. $300. value. **$104.50**

WELDING GENERATOR (200 Amp.)



Excellent direct current generator with full instructions for use as welder. Includes heat control, cooling fan, etc. Type P-1. Delco-Remy. 30-v. Cost $296. **$29.89**

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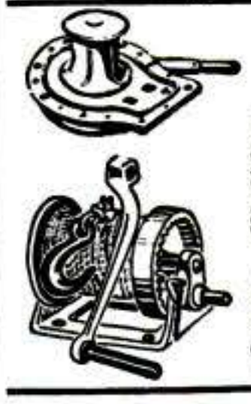

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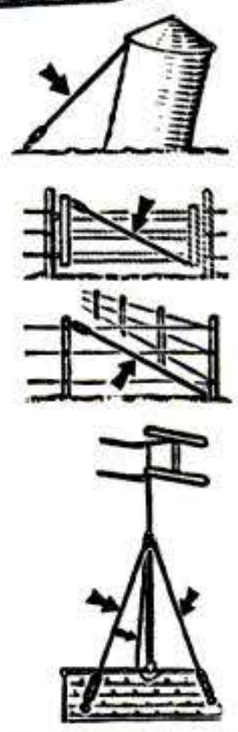

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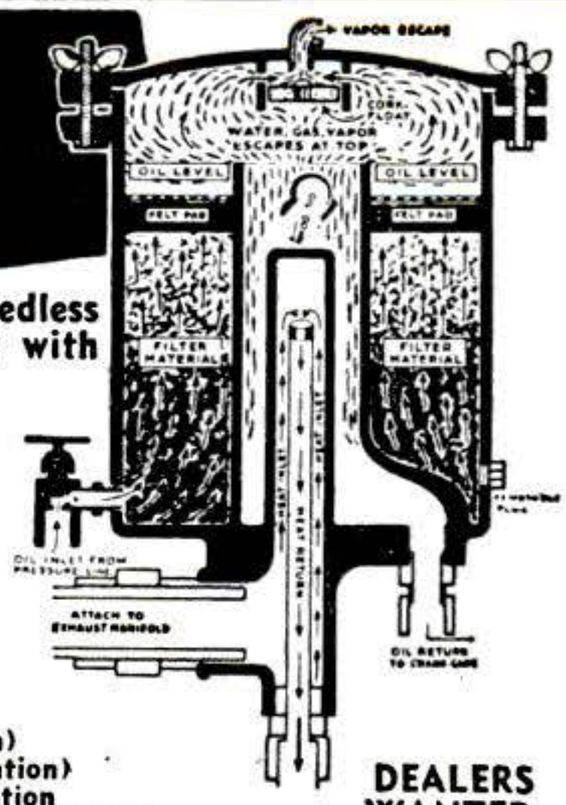

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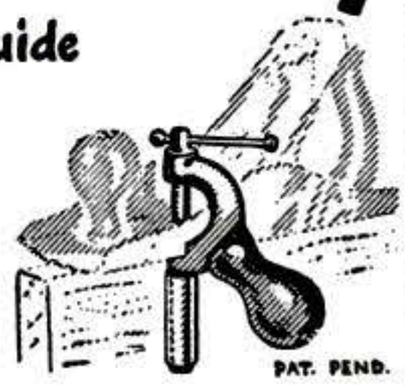

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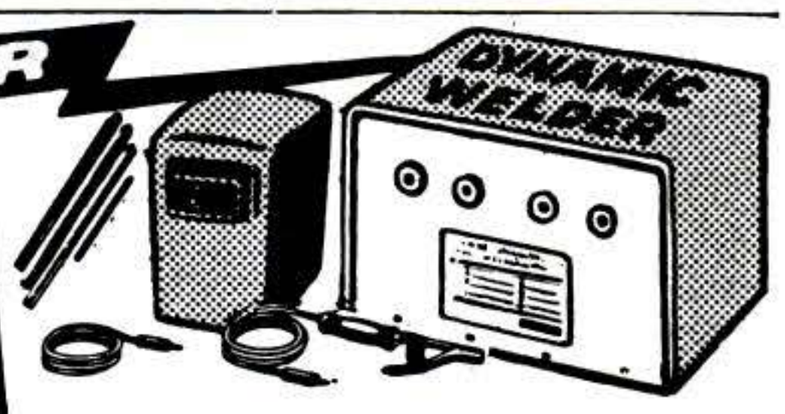

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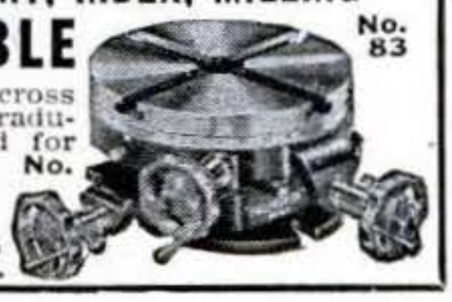

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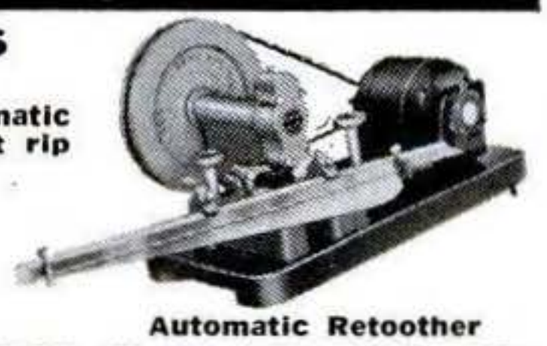
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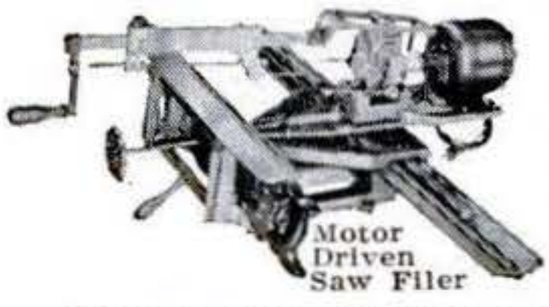
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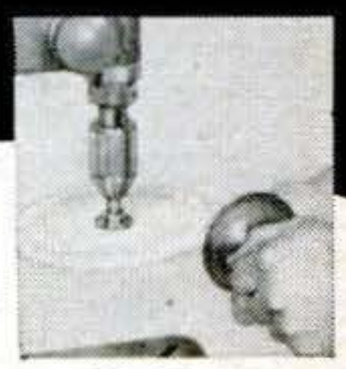
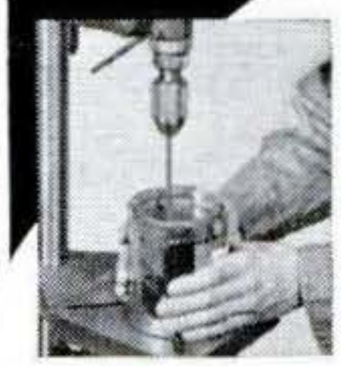

Buffing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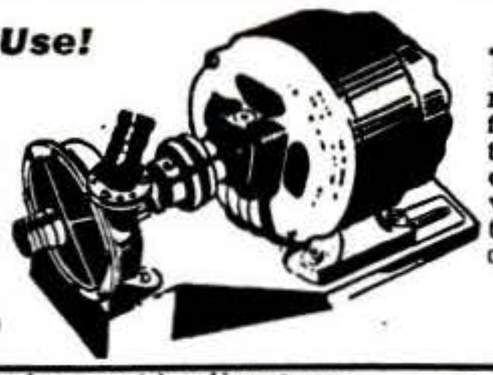
"LITTLE GUSHER" Pump irrigates, drains, waters live stock, fights fires! Pumps 2,000 GPH 25' high or 360 GPH 75' high. Has ¾ HP engine with 3" power take-off V-pulley. Engine adjustable from 1700 to 4500 RPM. Portable—only 26 pounds. Dollar for dollar, pound for pound, the best pump value at **$59.00**



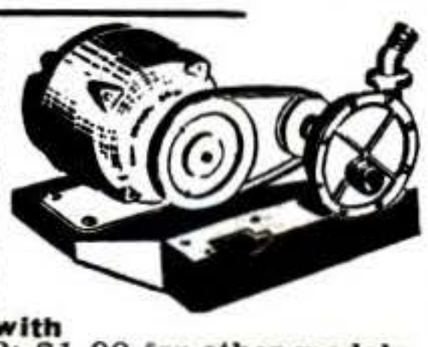
TYPE C-4 Pump has Direct Drive. Ideal for plumbing fixtures below sewer line. Complete with ¼ HP motor, $20.45. Without motor, only **$10.50**

TYPE D-3 Pump cleans 40' well or cesspool quickly! Operates in any position. Pumps 400 GPH 40' high or 1400 GPH 20' high. Complete with ⅓ HP motor **$25.45**

Without motor, only **$11.75**

TYPE E Pump has interchangeable direct or belt drive for all 'round use. **E-4** fitted with 5" pulley. Complete, with ¼ HP motor, $22.75. Without motor, only **$12.75**

E-3 fitted with 6" pulley. Complete with ⅓ HP motor, $24.75. Without motor, only **$13.05**



MONEY BACK GUARANTEE

All Bronze Foot Valve for 1" hose . . . $2.75
1" Suction Hose—per foot 35
⅞" Discharge Hose—per foot 20

All prices POSTPAID if check or money order with order. West of Mississippi, add 50c for Type P; $1.00 for other models.

LABAWCO PUMPS • Belle Mead 4, N. J.

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Kester Solder

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SHARPEN ONCE IN 12-YEARS! (UNDER NORMAL USE)

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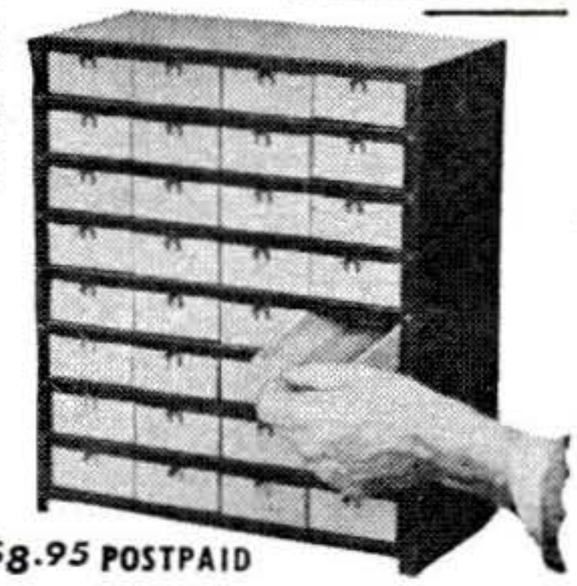
So handy to keep nuts, bolts, screws, nails, parts, washers, stamps, hobbyists' needs, etc., at your fingertips.



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Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

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32 Drawer Unit 6" Deep 12¾" Wide 15¼" High **64 Drawer Unit** 6" Deep 25½" Wide 15¼" High **Drawer Size** 1¼" Deep 2¾" Wide 6" Long	**Dividers and Index Cards Included** One piece rustproof aluminum drawers for heavy service—good for work bench and industry use. **32 drawer - $8.95** **64 drawer - $15.95**	**ONLY $2.95** **8 DRAWER UNIT** (24 compartments) **16 DRAWER UNIT** (48 compartments) **$4.95** **Specifications** 6" Deep, 8¼" High 8 Drawer 6⅝" Wide 16 Drawer 12¾" Wide

Ohio orders add 3% sales tax.
Marproof Rubber Feet included with all cabinets
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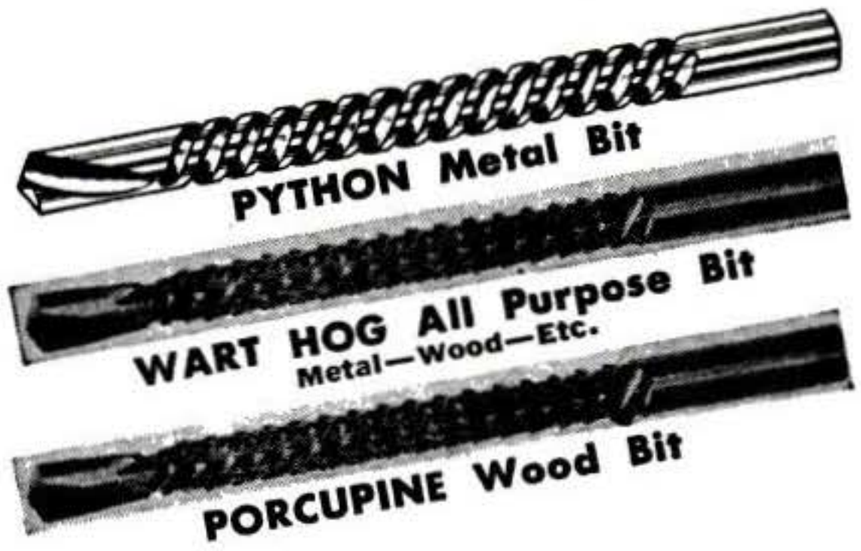
HI-SPEED COPE-SAW DRILL-BIT
IT SAWS CUTS REAMS

Presents The Big 3



Each Bit **Performs its own Function Specify Which**

SAWS, CUTS, REAMS Sheet metal, angle iron, pipe, wood, plastic, Transite, etc. Amazing high-speed combination bit and saw fits any ¼" or ½" electric drill or slow drill press. Drills own starting hole to quickly cut, saw or ream opening. Easy to operate. Ideal for carpenters, auto mechanics, electricians, plumbers, hobby workers, many others. Abrasive resistant high speed steel. No breaking. Will withstand severe continuous use. Resharpened at no charge. ¼" diameter, over-all length 3½", cutting section 2" long with flutes ground from solid. Shipped same day—money back guarantee. Discounts on quantity orders from dealers. Takes place of up to $50 in tools. SEND CASH, CHECK OR M.O.

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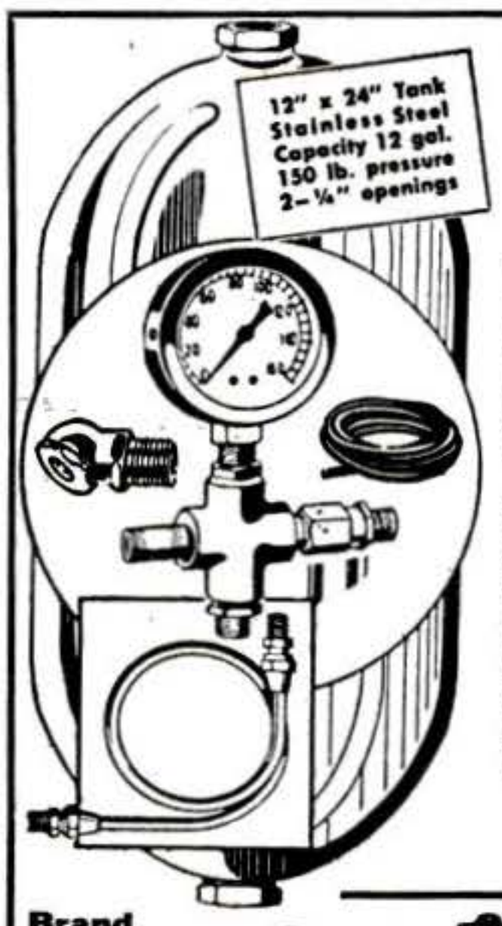
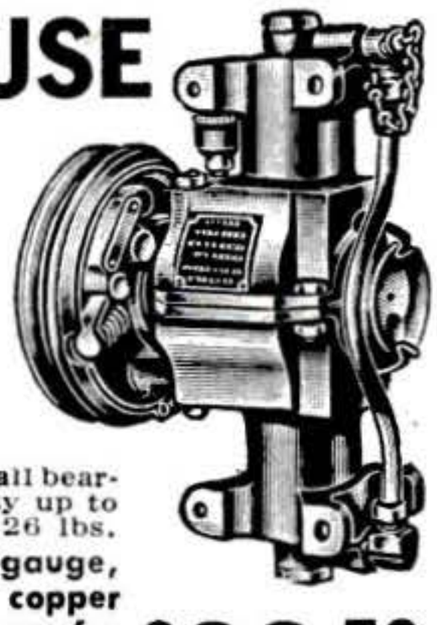


WESTINGHOUSE Air Compressor



Reg. $60.50 . . . Only

Model T-1 Brand New — 2 CYLINDER PISTON TYPE **$21.50**

Operates with ½ H.P. Motor or equivalent gas engine.

Compressor has 2" bore, 1½" stroke, ball bearing, 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11⅞"x6⅝". Wt. 26 lbs.

Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples.

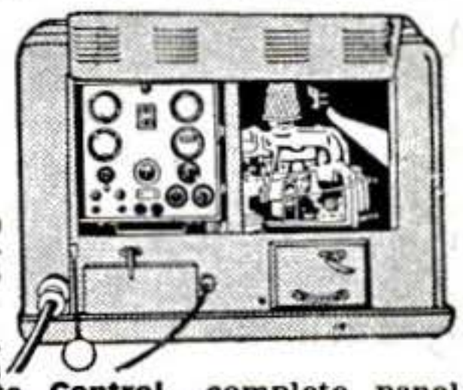
COMPLETE OUTFIT, wt. 52 lbs. **$32.50**

EQUIPMENT LESS COMPRESSOR, $12.50
COMPRESSOR SEPARATELY, $21.50
TANK ONLY, $6.95

LIGHT PLANTS

Brand New! War Surplus

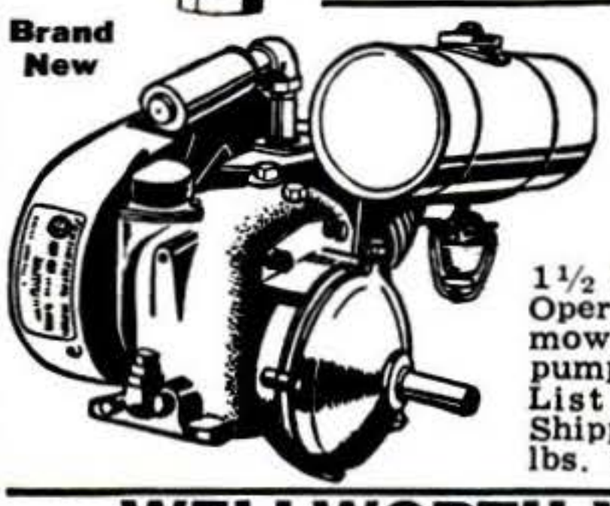
Signal Corps Power Unit PE 197



115 volt 60 cycle A.C. single phase 5 K.W. Hobart, water cooled. 14 h.p. 4 cylinder Hercules engine. **Remote Control,** complete panel board with instruments. 150 ft. automatic remote control cable with reel; 150 feet #6 heavy duty wire with reel; housed in metal case with replacement parts and tools. Cable with reels alone worth $400. Regular price of unit $1900. Shipping wt. 1250 lbs. Our price, complete, **f.o.b. Chicago** **$895.00**

Same unit, slightly used. Reconditioned. Fully guaranteed ..... **$495.00** less cable

2½ K. W. LELAND POWER PLANT **$295.00**



Brand New

Save 50 % on Gas Engines!

Red Seal Continental

6 to 1 REDUCTION GEAR
1 CYLINDER — 4 CYCLE

1½ HP with 6 to 1 reduction gear. Operates at 450 R.P.M. For lawn mowers, scooters, garden tractors, pumps, compressors, generators, etc. List Price $79.50. Shipping weight 54 lbs. SPECIAL PRICE **$39.50**

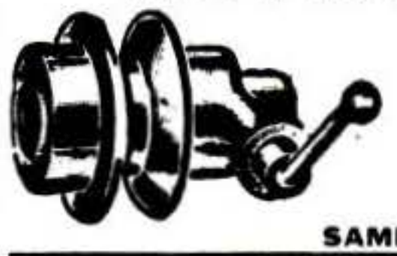
AUTOMATIC COMPRESSOR UNIT

⅓ H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle, 2x1¾ inch piston type compressor, splash feed lubrication. 12x24 inch tank, automatic pressure switch. CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2"x10" pneumatic tires. Portable with handle. Shipping wt. 90 lbs.

SPECIAL PRICE..... **$89.50**

Same unit with Gas Engine **$99.50**

WELLWORTH V-BELT CLUTCH



Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter. ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. Bushing for ½" shaft, 15c **$7.50**

SAME CLUTCH FURNISHED WITH ¾" bore $8.50

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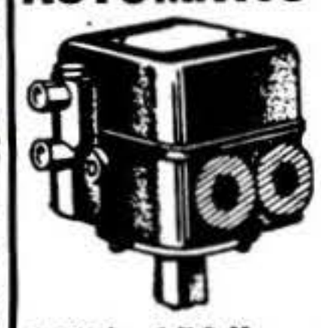

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20 to 40 lbs. **$5.95**

75 to 100 lbs. **$8.95**

125 to 150 lbs. with unloader..... **$11.95**

¼" check valve..... **$2.75**

½" check valve..... **$4.50**

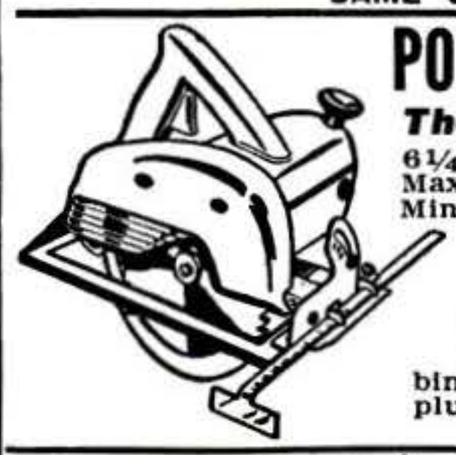
AIR REGULATOR AND EXTRACTOR

¼" Air Regulator, Gauge and filter. Wt. 5 lbs. **$8.95**

Regulator and Gauge only..... **$5.95**

Air Filter only..... **$3.25**

PORTABLE ELECTRIC HAND SAW



The Zip Sawer With ALL the Features

6¼" Diameter saw blade, ½" square arbor hole. Maximum depth of cut 2⅛". (At 45°, 1¾".) Minimum depth of cut 0". Angular adjustment 90° to 45°. No-load speed, 5200 r.p.m. Full load speed, 3200 r.p.m. Amperes, full load, 8.0. Universal AC-DC motor, 110/220 volt. Dimensions: 11¼" long; 9½" wide (ripping guide removed); 7⅛" high (without blade). Furnished complete with 6¼" diameter combination blade and 10 ft. cord and plug. Wt. 11½ lbs. Price..... **$39.95**

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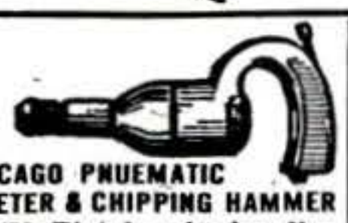
Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛"x11⅜"; inlet 8¾". Height 19". Width 18". Depth 16½"; C.F.M., ¼" S.P. 1600; outlet vel. 1575; motor ¼ H.P. with overload relay; cord & plug 110 v. 60 cy. A.C. Ship. wt. 67 lbs. Special price.. **$42.75**

Blower less motor and drive.. **$27.50**



CHICAGO PNUEMATIC RIVETER & CHIPPING HAMMER

CP4X Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00. **BRAND NEW**..... **$32.50**

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CLARK DRILL . . . Fully reconditioned and in tip-top shape. Made to rigid Government specifications and will take most rigid abuse. 110 volt A.C. Cycle. 1 phase, Ball Bearing motors in 5,000 R.P.M. 1/4" Jacobs Chuck . . . 8 ft. cord and plug . . . . . A $55 VALUE **17.95**

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3/4" HEAVY DUTY – 2 SPEED

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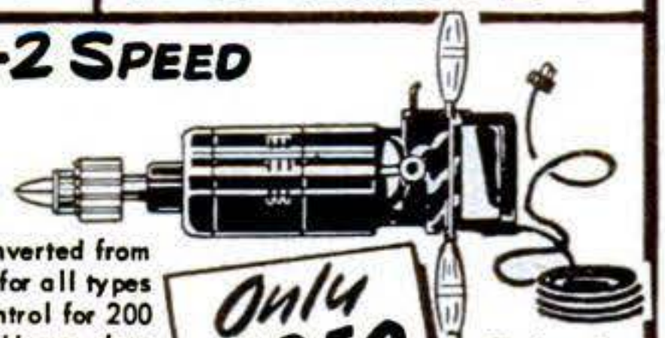

Never before such a value. Converted from aircraft starter-energizer. Ideal for all types heavy drilling. Has 2 speed control for 200 RPM low, or 275 RPM high. Heavy duty gear box gives extremely high torque. ¾" Stndrd. Jacobs Chuck. Universal ball-bearing motor – 110 - 115 volt AC or DC. Length 32 inches.

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NASCOLITE – Full sheets app. 1/8" x 37½" x 49½", app. 10½ lbs. each $12.50

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5/16" x 36" x 24"... Per Sheet.. **$13.00**
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Here's a real Shock Absorbing watch. Has jewel movement, Sweep second hand, luminous dial, chrome case. Guaranteed for one year. Ideal for young and old. . . . . $6.95 Plus 10% Fed. Tax.

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Pocket type. 60 second dial divided into 5th's of second. Also 30 minute recorder dial, shatterproof crystal. This genuine Bureau of Ordnance watch has $35.00 value. Shipped in steel, shock-absorbing suspension case. 15.95 Plus 10% Fed. Tax.

17 JEWEL Chronograph. One of the finest made anywhere. Cased in Switzerland. Sweep second hand, stop and re-set buttons. Measures distance, airspeed, groundspeed, races. Ideal for the sportsman. . . $23.95 Plus Tax

17 JEWEL AUTOMATIC WRIST WATCH . . . Swiss made men's wrist watch. A real self-winding watch . . . winds itself while you wear it. Incabloc (shock protected). Swiss movement. Sweep second hand, luminous dial and hands. Silver white or black face. Waterproof nickel chrome case. Stainless steel back. Hours marked in numerals. Genuine leather strap. Red second hand with arrow tip . . . . . GUARANTEED

PLUS 10% FED TAX **Only 23.95**

Genuine ARMY AIR FORCES SUNGLASSES

HERE'S THE REAL McCOY!

ARMY AIR FORCE - 6 base. Precision Polished & Ground Glare-Free calibar lenses. Leather case to be attached to belt. Gold plated adjustable frame. Pearloid sweat bar and pads. $17.50 Palley value for ONLY $3.95

With 57mm yellow, amber, 6 base lenses. Optically precision ground and polished! Your doctor will recommend these. Not a cheap "Process" lens. Reduces headlight glare and sharpens 'object focus' during night driving.

Men's size or Ladies Harlequin style. ND-1, $16.00 VALUE 14.29
SAME GLASSES but clip-on's. 3.95
Fit-over style without temple bars.

Aviators (AN-6530) Windproof & Dustproof

GENUINE GOGGLES

Rubber or chamois covered frame. Clear or Green GROUND LENSES are inter-changeable. Adjustable nose bar. Ideal for flying, motor cycling, etc. $1.69

GO-1 GOGGLE KIT

NEW! U.S. Navy – Has soft sponge rubber frame. 4 Polaroid lenses 2 green, 1 red, 1 clear. Perfect for racing, cycling, etc. 89¢

MESS TRAY – 6 compartment Stainless Steel – Rustproof – Ideal for Home, Camp, etc. Used but excellent condition . . 79¢

ARMY PUP TENTS 2 Man . . . Used . . . Perfect . . 5.95

HUNTING KNIFE . 6" Polished blade, leather sheath 1.69

BOLO KNIFE 10" Parkerized blade, with case 1.19

PLASTIC PARALLEL STRAIGHT EDGE

with knobs and rubber pads for non-slippage on each section. A must for navigators, mechanics, draftsmen and engineers.

You've never seen 'em at . . . . 97¢ ea.

AAF FLEECE LINED JACKET

Will keep you warm & comfortable in the roughest weather. Fur lined thruout sleeves & body. 2 slash pockets & hvy duty zipper. Ideal for Farmers Ranchers, Hunters and Mechanics.

RE-CONDITIONED and in WONDERFUL CONDITION! 9.95

MICROPHONE

Telephone type– Highly Sensitive with excellent, clear tone. This was the Signal Corps favorite. An ideal instrument for the radio 'ham' and professional recording studio, broadcasting, home recording, public address, etc. A Sensational Buy! Complete with cord and plug. . . . ONLY 2.29

RADIO HEADSET

Low Impedence. Ideal for amateur radio, crystal sets, or professional use. Adjustable ear phones. Used and in excellent condition. . . 1.69

FLYING SUIT or Blue Bunny SUIT

For hunting, winter sports, skiing or "bundling". As coveralls for cold outdoor, or farm work, 100% woven wool with extra flannel inner lining for double warmth & utility. Wiring so fine, flexible it does not interfere with movement. Can be used with or without heating or can be plugged into car, tractor, or truck battery. Sizes 36 thru 44. $3.49

COMPASSES –
Match Box . . . . . 39¢
Jeweled Watch–Pocket 1.59
Wrist Strap Type . . . . . 69¢

15" MONKEY WRENCH

Adjustable Jaw – Opens to 4"
Drop Forged. . .Auto Type.
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Trim, smart military cut jacket – for sports and outdoor wear. Warm and comfortable. Has two patch pockets – two inside pockets – adjustable side straps. Waist belt with buttons and snaps. . . . . .

ONLY 5.95 each

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Fine grade leather .. Chamois lined with chin cup on strap. Intermediate weight .. Ideal for summer wear. NEW ONLY . . 1.59

All New! Winter type with fleece or chamois lining. Has ear puffs & chin cup. Ideal for pilots, cycle – drivers, sportsmen, etc. 1.95

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A Sturdy Boot of finest rubber. Completely Waterproof with adjustable strap. Worn with or without shoes. 3.95

FELT INNER-SOLE & SHOE PAD INSERT – for Cold Weather (Sold only with boots.) Set complete. . 1.50

NEW NAVIGATOR'S MAGNETIC COMPASS

D-12 Type – Rotating verge range ring, calibrated in 1 degree increments from 9 to 360°. Two parallel grid wires for N-S line alignment Fine for boats, etc. 14.95

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Stainless Steel, Shatterproof & Rustless. Ideal for painting, cooking, spraying, ocean buoys, underwater fishing, or diving.

G-1–12½ x 24 inches. 2100 Cu. In. capacity 4.75
F-1–10 x 18 inches. 1000 Cu. In. capacity 4.19
F-2–6 x 45 inches. 1000 Cu. In. capacity 3.95
D-2–6½ x 24 inches. 500 Cu. In. capacity. Stainless Steel Construction 3.49
D-2A–Corrosion resistant steel. Same as D-2 . . . . 2.49
A-6–5½ x 15 inches. 280 Cu. In. capacity 2.25
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NOTE: All tanks are guaranteed serviceable and free from leaks or dents

TANK

Dural with welded seams, 2" filler with cap, two standard pipe parts for hookup. Visible liquid level gauge on side. Ideal for Gas, Oil, Water, or "spare" on auto, tractor, truck or boat. Sturdy, light. Capacity 6 gal. 14.95

NEW TANK

For Gas, Oil, Water, etc. Seamless, welded tank, made of aluminum with filter Screen and Pack. Has stick level gauge. 19 gal. capacity 16.95

Order from this Ad. All sales final. All Prices F. O. B. Glendale. Pay by M.O or Check. P.O.'s Accptd. from D. & B. firms. ½ deposit with C.O.D's.

PALLEY SUPPLY CO

Dept. PS–1 GLENDALE, CALIF.

LARGEST FIRM OF ITS TYPE IN THE WORLD

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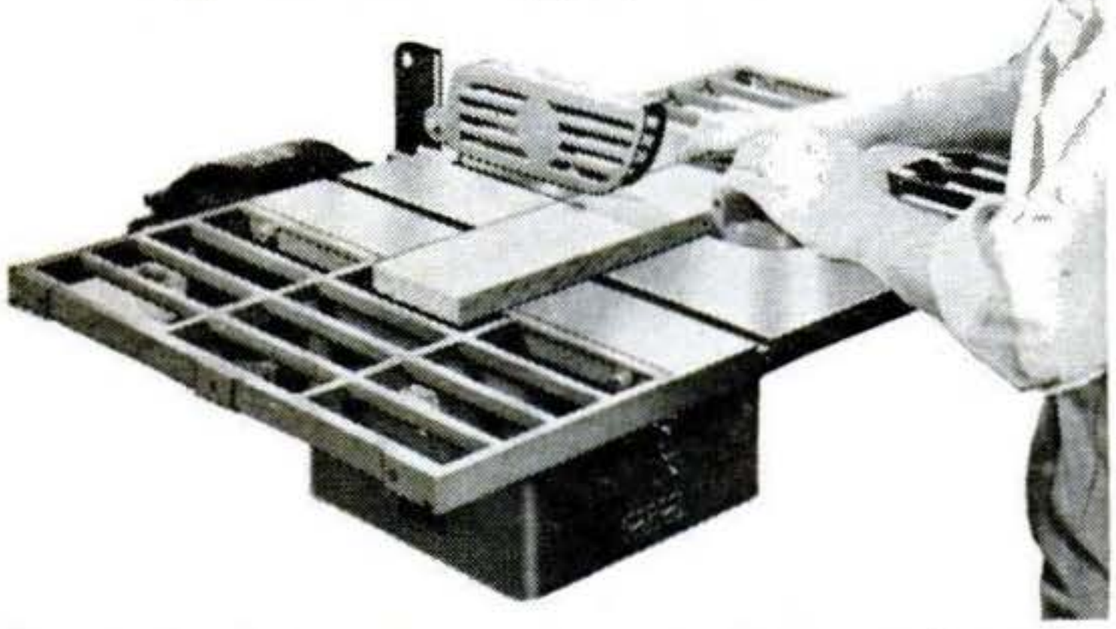
The Original Low Cost 8" Tilt/Arbor Saw!

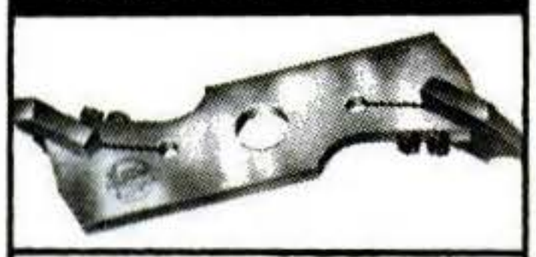
Atlas POWER KING



STILL TODAY'S BEST BUY!

Many have copied it — but no one has successfully included *all* the performance features of this Atlas-Power King at anywhere near the price! Here is just about everything you could want for all your home and furniture construction projects. A saw that speeds your work, keeps it accurate — a saw built to give you a lifetime of good service at low cost. See it at your Atlas-Power King dealers.

Atlas MOULDING and DADO HEAD



Fits any saw with ½" or ⅝" arbor — cuts dados, handles all straight shaping jobs.

Some of the Outstanding Features

★ Tilt/Arbor, Ball Bearing Construction!

★ 2⅝" Depth of Cut — Greatest In Its Class!

★ 11½" Table Surface Ahead of Blade When Cutting 1" Stock!

★ Big Precision-Ground 16" x 20" Grey Iron Table! 34" x 20" With Two Low-Cost Extensions.

★ Quick Positioning Rip Fence — Locks At Both Ends.

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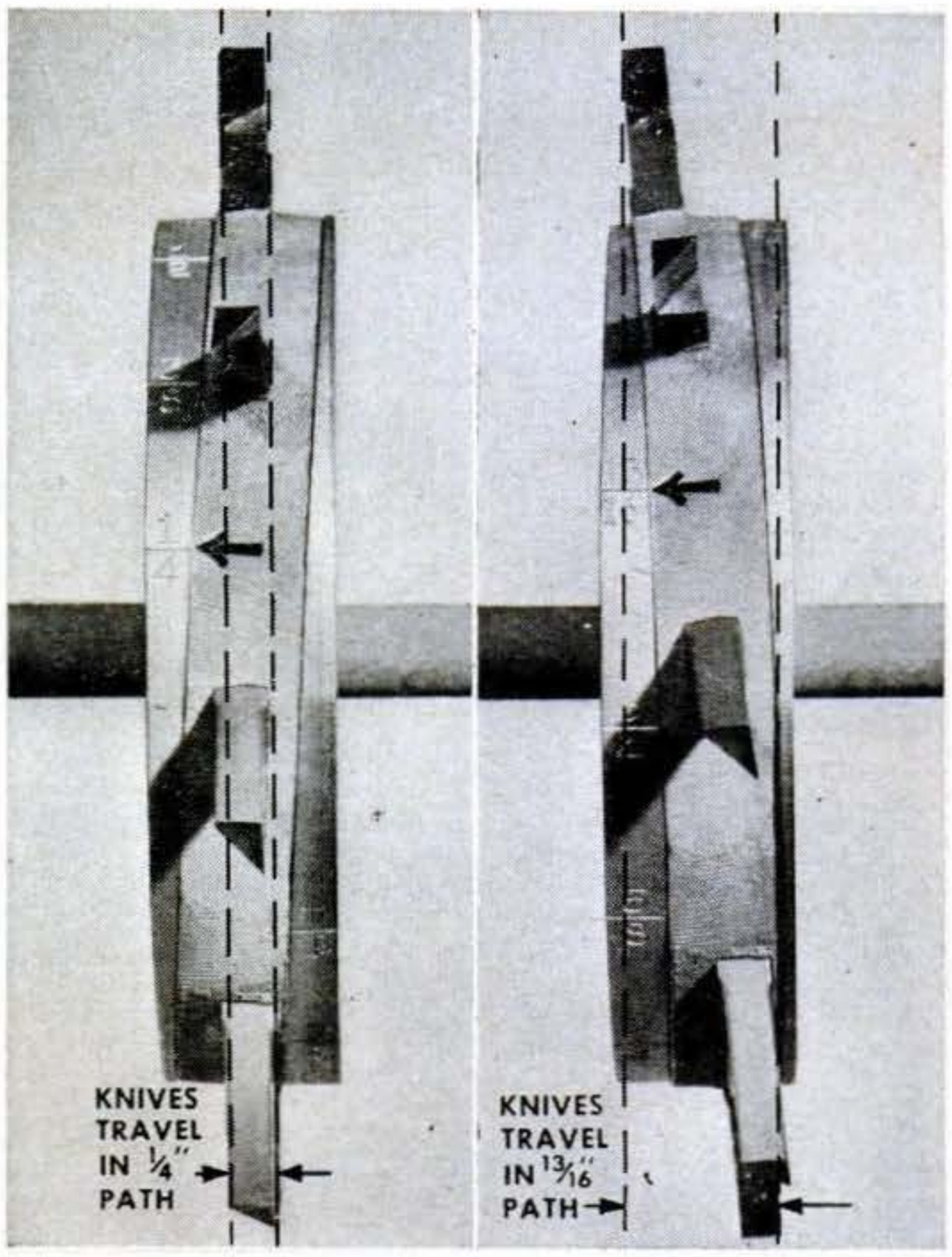
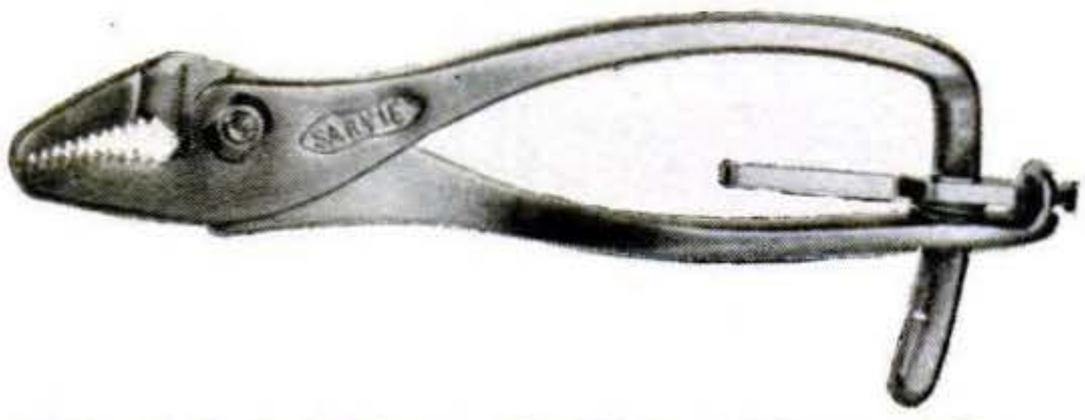


Adjustable Tool Cuts Dadoes. Without removing this tool from the saw arbor, it can be adjusted to cut dadoes from ¼" to 13/16" wide and up to ¾" deep. It's built of interlocking aluminum side plates and a center disk of steel. The plates are machined flat on the outside and at an angle on the inside. By loosening the nut on the arbor and rotating the center between the sides, the width of cut can be varied. Consolidated Machinery & Supply Co., Ltd., Los Angeles, prices the tool at $19.75.



Slip-Joint Pliers Self Locking. These pliers can also be used as a wrench or clamp because of a self-locking feature. The jaws open to ⅞" for locking action and to 1¼" for pliers action. Sarvie Tool Co., Alexander, Minn., prices the tool at $1.85.

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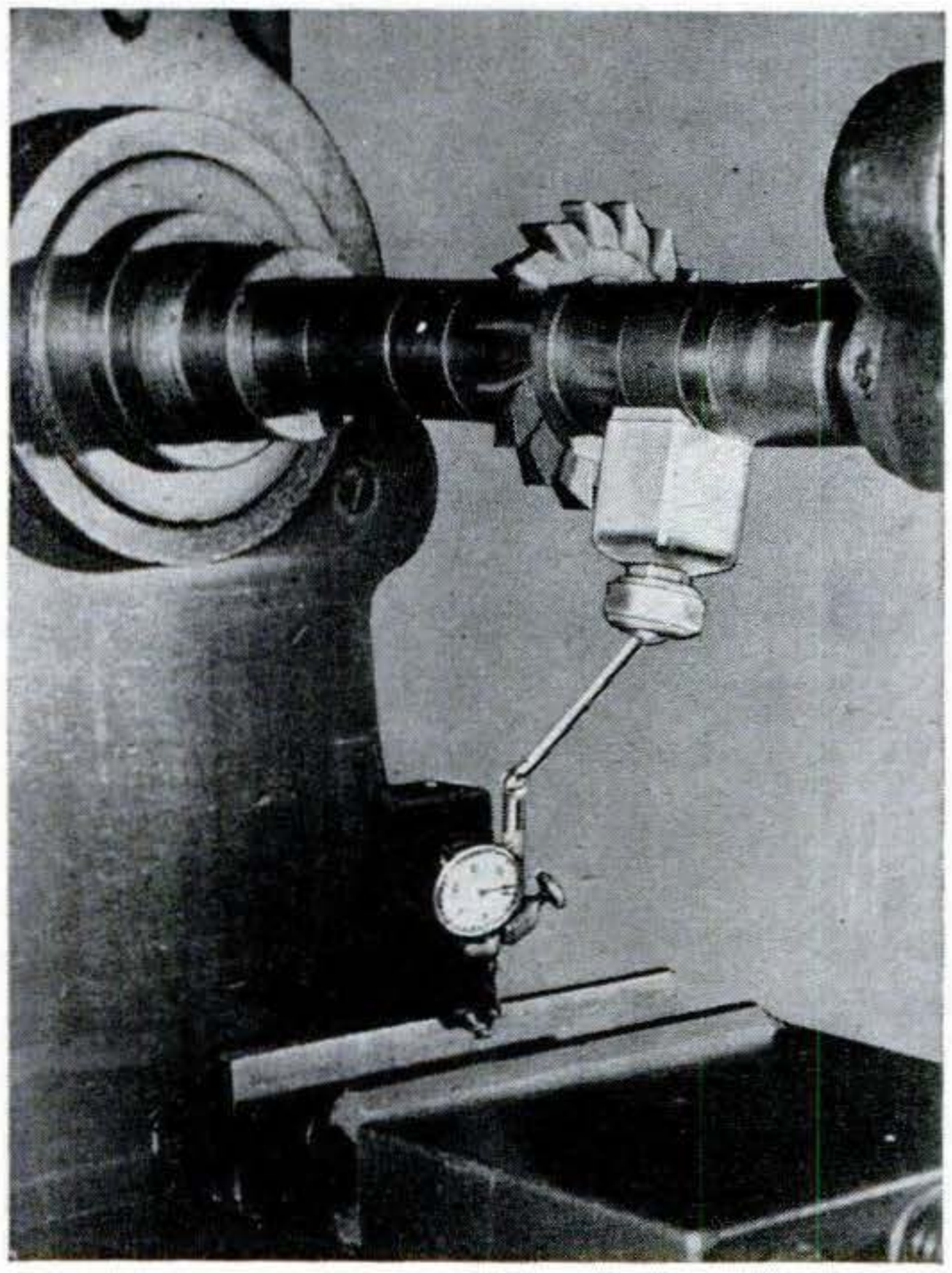
Tools



Magnet Holds Test Indicator. This holder, made by Enco Manufacturing Co., of Chicago, can be mounted on any ferrous-metal surface to simplify test setups. The Alnico magnet in the base exerts about a 50-lb. pull and will stick to a round or flat surface. Instead of an indicator, a light can be mounted in the holder.

Hammer Is All Head. The hammer pictured above is designed for direct, lengthwise tapping, rather than the swinging blow delivered by an ordinary hammer. You hold it by the knurled center section and deliver a blow with either end of the 12-ounce hammer. The plastic tappers will not break or chip, according to the manufacturer, Ready Tool Company, of Bridgeport, Conn. The price is $1.50.

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Quick-reading, error-proof tapes made to Starrett standards of accuracy from the finest tape steel. Types, lengths and styles of graduation to suit every need. In both English and Metric. See them at your Starrett Tool Distributors.

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3/8" tape line with ring, patented hook and folding wind-up handle. 25, 50, 75 and 100 foot lengths. Handsome, extra-durable red artificial leather cover over plated steel case. Popular price.

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A quality tape with genuine leather covered steel case.

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3, 5, 6, 8 and 10 foot lengths, nickel plated case, push-button spring wind.

No. 537 Frame Tapes
Ideal for field work. Steel frame, hardwood grip, flush folding wind-up handle.

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For gaging oils, gasoline, water, etc. Bobs for measuring innage or outage.

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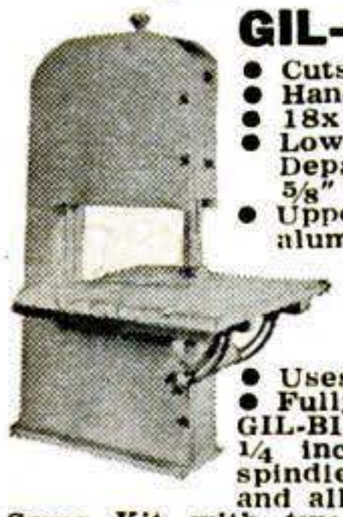
- Sturdy wood, aluminum, and steel construction
- Capacity and performance of commercial saws selling for $60 and up

GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table. 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jackscrew mechanism and handwheel, and all other metal parts (less blade) **$20.95**
Same Kit with 10" Combination Blade . **$24.90**
Same Kit with 8" Combination Blade . . **$23.90**

GIL-BILT 12-INCH BAND SAW



- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs
- Uses standard 78 inch blades up to ⅜ inch wide
- Fully enclosed mechanism for utmost safety

GIL-BILT Metal Parts Kit includes Plans, rubber tires, ¼ inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts **$16.95**
Same Kit with two machined ready-to-install 12" cast aluminum wheels $20.95

Return Kits in 10 days for refund if not satisfied.
(Prices include postage within 600 miles. Over 600 add 5%)

Also available—Plans and Parts Kit for 8" Tilt/Table saw. Order Plans at $1.00 each—sent postpaid anywhere in the world or write for FREE descriptive catalog.

GILLIOM POWER TOOLS P. O. Box 1-VA, Lambert Field St. Louis 21, Missouri

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Advanced designs, new all-die-cast (aluminum) construction and bigger motors. Lighter, handier, yet faster-drilling than more expensive, more cumbersome old style drills. Drill steel, wood, concrete or stone rapidly and efficiently.

See these new SpeedDrills before you buy; for more drill per dollar and more power per lb.

No. 400 ½" capacity—more power than drills costing almost double. Jacobs Geared Chuck, removable top handle. **$39.50**

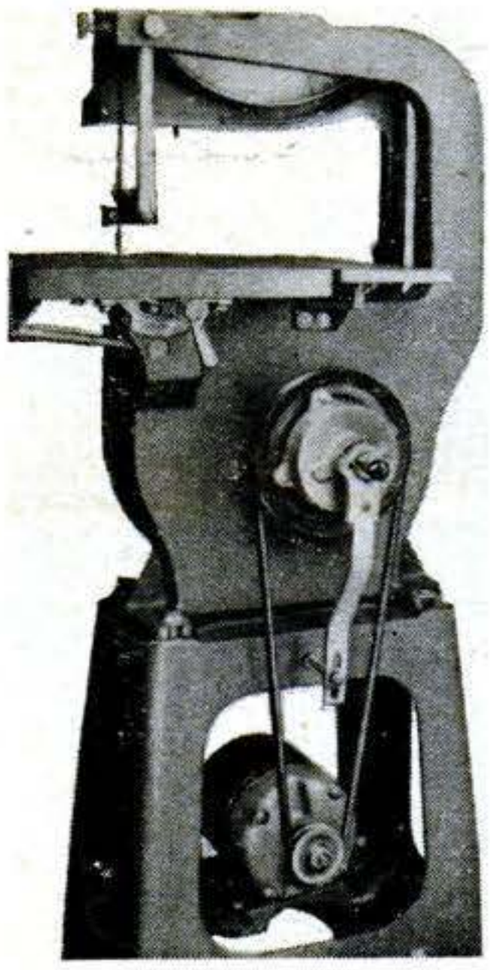
No. 79 ⅜" capacity—power of ordinary ½" drill. **$22.50**
With Jacobs Geared Chuck **$27.50**

No. 200 ¼" capacity. Fast-drilling with added power. **$16.50**
With Jacobs Geared Chuck. **$19.50**

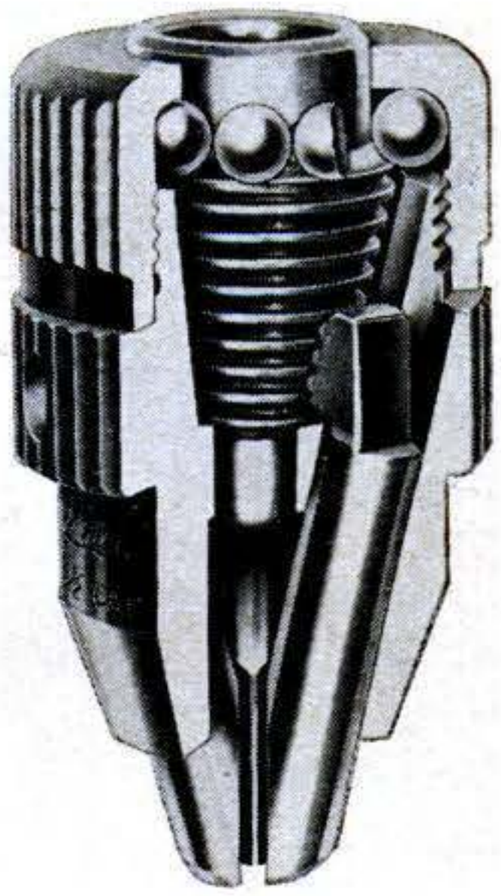
Write for Circular on drills, grinders and sander

SpeedWay MANUFACTURING CO.
1864 So. 52nd Ave., Cicero 50, Illinois

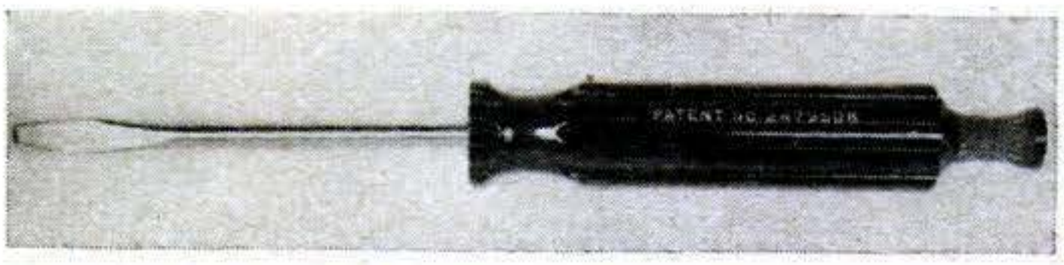
New Tools



Gears for Bandsaws. With this speed-reduction unit, a wood-cutting bandsaw can be used to cut metals. The unit comes mounted on an 8" pulley that replaces the pulley on the bandsaw. Speed reduction is 16 to 1. Pulling or pushing the gear-shift plunger on the 8" pulley changes the saw for metal or wood cutting. The unit, manufactured by The Erwood Company, of Crystal Lake, Ill., fits a ¾" shaft and is supplied with ½" and ⅝" bushings. It has oil-less bronze bearings and ground steel shafts. Price is about $30.



Keyless Chuck. Tools such as drills, reamers, counterbores, or end mills can be inserted and hand-tightened in this chuck. Machining action centers the tool and tightens the grip. The chuck—made by Ettco Tool Co., Inc., of Brooklyn, N. Y.—can be used on a drill press, electric drill, lathe, or milling machine. It's available in four sizes with capacities from 0 to ⅝". Prices run from $6.50 to $12.50.



Screwdriver Has Two Speeds. The larger diameter of the handle gives you leverage to set or loosen screws. The knob on the end lets you twirl the screw in or out rapidly. The maker, John R. Perkins, of Wayne, Me., says the tool is 30 to 50 percent faster than an ordinary screwdriver. Phillips, ¼", and 3/16" points are available.

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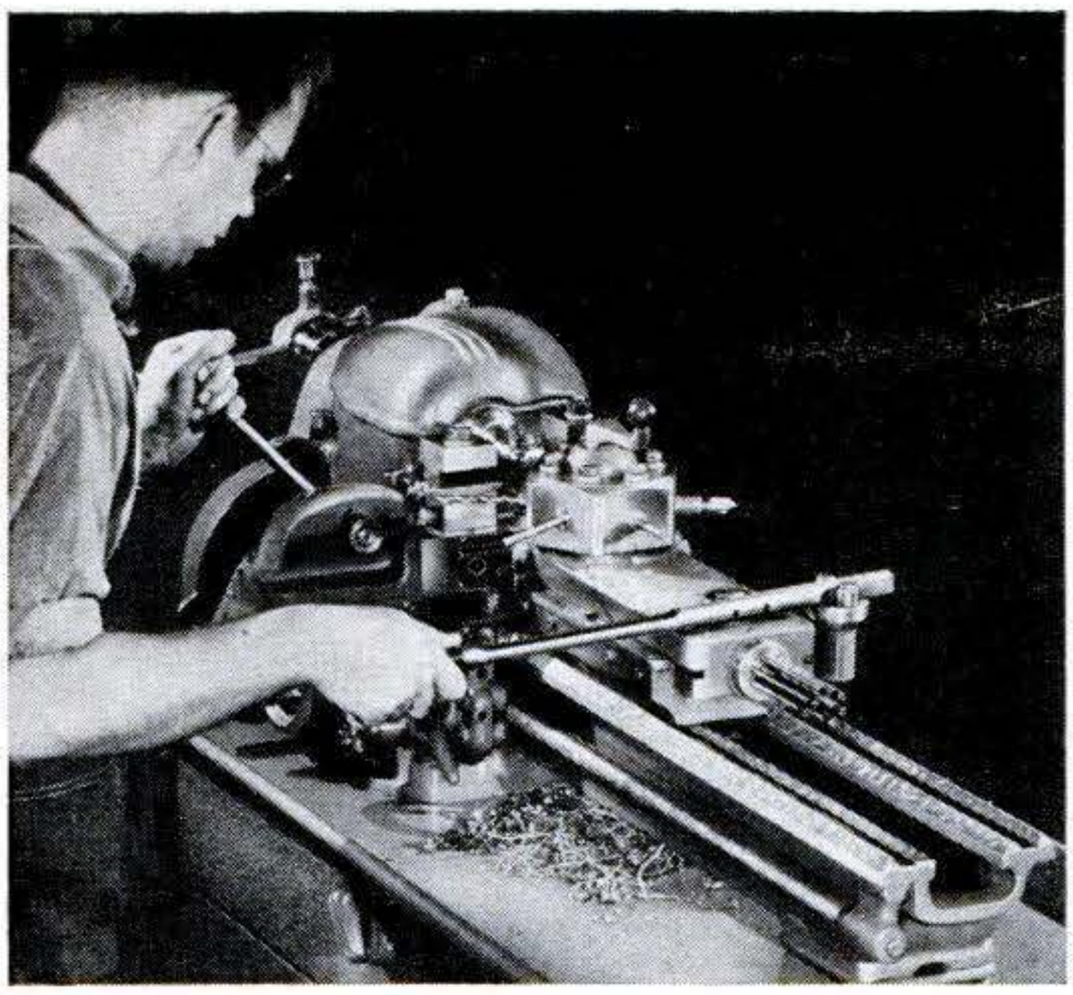
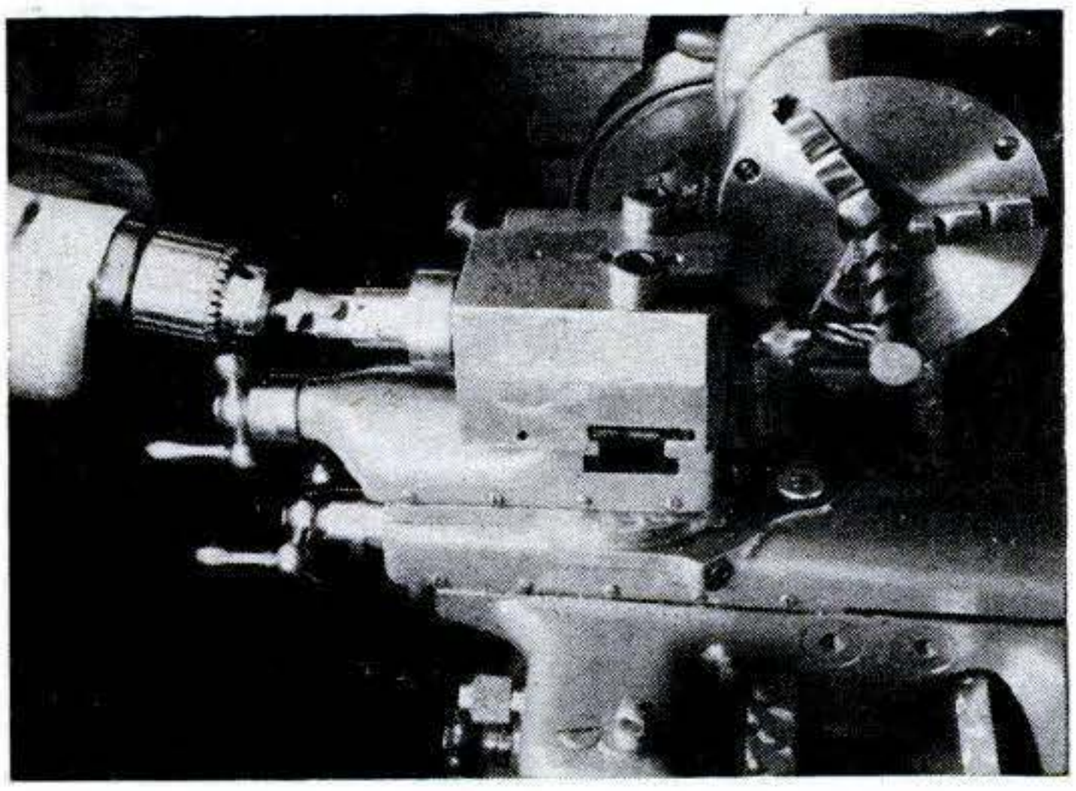
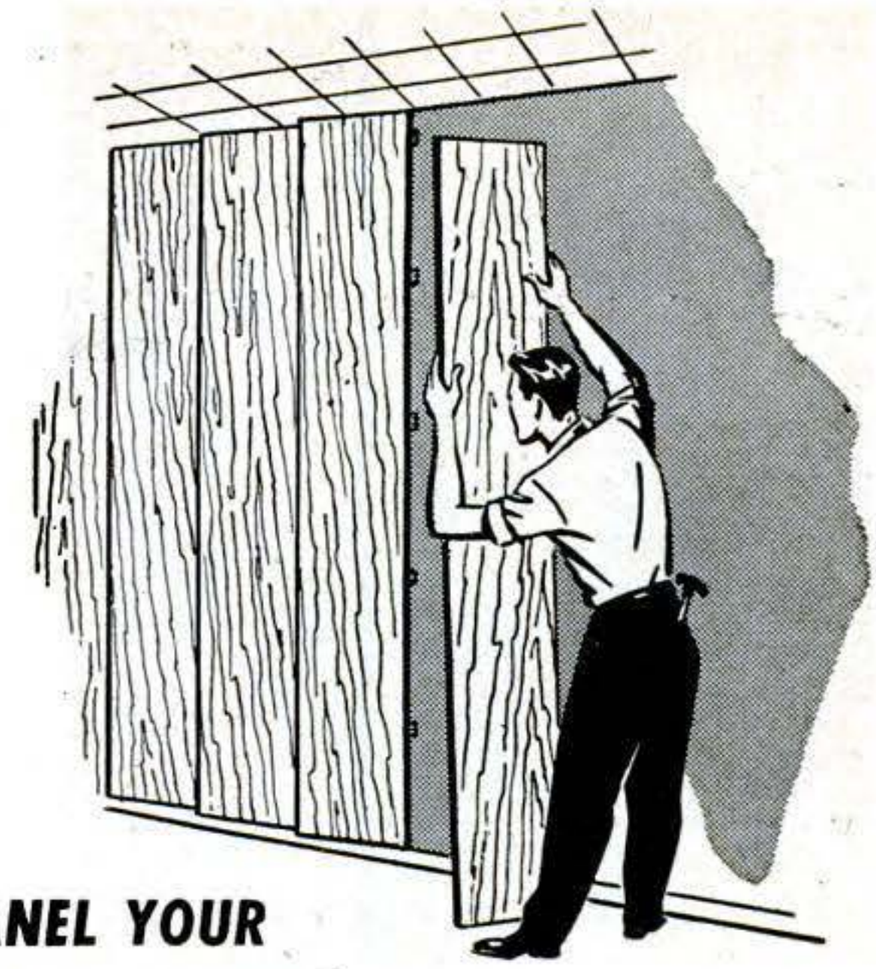


Bed Turret for South Bend Lathes. This bed turret turns a lathe into a production machine but does not change the basic lathe. South Bend Lathe Works, of South Bend, Ind., makes the turret for their 9″, 10″, and 13″ lathes. The turret mounts on the inside bed ways and can be locked in any position on the bed. The base is designed to clear the saddle wings so the turret head can be brought close to the spindle nose. The head may be bored to take six ¾″- or ⅝″-shank standard turret tools. Effective feed of the turret slide is 4″.



Lathe Accessory Powered by Drill. This milling converter mounts on the compound rest of a lathe. An electric drill supplies power that is transmitted to the shaft through a universal joint. In the photo above, the converter is doing a spiral milling job. Other work that can be done with the tool includes slotting, end milling, angle drilling, radial drilling, keywaying, and pattern working. The tool can be adapted for grinding jobs. It is sold for about $15 by Martin Laboratories, of Los Angeles.



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Plankweld fits perfectly over 16″ studs on new work. And the concealed metal clips that secure the panels to the wall eliminate practically all face-nailing.

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P.S. Last minute news & notes...

A MICROSCOPE so powerful that atoms now can be seen--for the first time --has been perfected by Dr. M. J. Buerger, a mineralogist at Massachusetts Institute of Technology. By first using X rays, then using visible light, he has achieved magnifications approaching a million diameters and photographed individual atoms in crystals.

PROPELLERS for 1,000-m.p.h. airplanes are being tested now. They have been designed by the Curtiss-Wright Corp., for turboprop engines of 20,000 hp. . . . SMOKELESS POWDER has been put into JATO booster rockets used by the armed services to help planes take off from short runways and carrier decks without smoking up the place.

BADLY BURNED persons often die from shock but can be saved, the Public Health Service says, by giving them salt and soda in water to drink as soon as possible. Dissolve exactly one level teaspoon of table salt and one-half teaspoon of baking soda in a quart of cool water. A burned person should drink as much as he can without vomiting, not be given anything else until doctor comes.

AN ATOMIC BOILER for students to use and visitors to see is to be built at North Carolina State College in Raleigh. The Atomic Energy Commission will supply the fuel, but will neither own nor operate this reactor. Like one at Los Alamos, it will be run with Uranium 235 in a solution inside a stainless-steel cylinder surrounded by concrete.

WOUNDS and infections that now call for surgery may some day be treated with trypsin, an enzyme that helps digest food. Experimental work at Ohio State University indicates it can be used to dissolve dead tissue without affecting living tissue.

A PNEUMATIC TUBE SYSTEM with a "brain" has been developed by I.T.&T. Setting a dial on the carrier cartridge sends it to any of 40 receiving stations through a central switching system that works like an automatic phone exchange.

A HARVARD SCIENTIST challenges the belief that abnormalities at birth are caused mainly by heredity. His experiments with mice, reports Dr. Theodore H. Ingalls, point to prenatal environment--disease or injury suffered by the mother--as the reason why some children are born with such deformities as cleft palate, hare lip, club feet, and Mongolism.

HOUSEFLIES not only are becoming immune to DDT and other new insecticides--they're learning to avoid them. And these habits, says the U.S. Dept. of Agriculture, appear to be passed on to succeeding generations, even though the youngsters have never encountered the poisons.

INVENTIONS: A machine that can discriminate between speech and music has been developed by Dr. R. Clark Jones of the Polaroid Corp. It is a small 4-tube device that detects the pauses, which are more abrupt in speaking than in singing. It will shut a radio off automatically when the music stops and someone starts to talk. . . . A MAN IN MISSOURI has patented a harness to keep peoples' mouths shut when sleeping, and so prevent snoring.

NEW PRODUCTS: Plasticloth, a waterproof plastic sheeting, makes handy drop cloths to protect furniture and floors during painting: dried drippings shake right off. . . . Using nylon, Underwood gets an extra four yards of typewriter ribbon on a spool. . . . Carilloy steel, developed by Carnegie-Illinois, stays tough even below zero. It's expected to save weight in military and road-building machines.

The Editors

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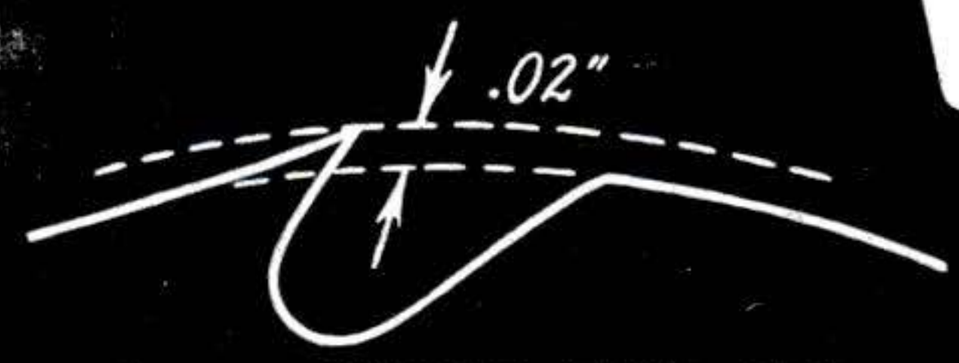
Amazing New SAFETY SAW BLADE



WHAT THE PTI "Cut Control" BLADE IS:

Each P T I Saw Blade has only 8 teeth instead of the customary 100. These teeth are entirely different from the conventional saw tooth — they project only 20/1000" above the non-cutting edge. Thus the cut of each tooth is "controlled" by the non-cutting edge, in contrast to the ordinary saw blade where each tooth cuts right down to its base. This relatively simple alteration in design actually works miracles in the performance of the saw blade.

CUT CONTROL

THE PTI SAFETY SAWBLADE

PATENTS PENDING

Embodying a radically new cutting principle

Here is the greatest improvement in circular sawing — since the invention of the circular saw. It's the sensational new *P T I Cut Control* Saw Blade that brings long-needed safety and remarkable *new* efficiency to this important power tool. Never before has a saw blade been subjected to such gruelling, thorough tests, to such careful checking and re-checking by leading laboratories, government agencies, universities, and industrial concerns. And never before has a saw blade made such astounding records in safety and cutting efficiency. No other saw blade today can offer you so many exclusive advantages, including:

1. **Complete Safety From "Kick-Backs"** — Since the teeth are only 20/1000" high — they cannot grab the wood and throw it against the operator — eliminating one of the most serious causes of circular saw injuries.
2. **Reduced Direct Injuries** — Cut Control teeth do not drag the hand into the saw. The non-cutting edge acts as an effective stop to cuts and limits their depth.
3. **Cuts Chips — Not Sawdust** — unique cutting action produces chips. Easier to clean. Eliminates fire hazard of spontaneous combustion.
4. **30% to 40% Power Saving** — Fewer teeth mean fewer cuts to achieve same results — hence less power consumption.
5. **Longer Life Without Sharpening** — When cutting off chips — the wedge action of the tooth does most of the work — which means less wear on the cutting edge of the teeth.
6. **More Efficient Cutting** — Each tooth is backed up better against body of blade. It is therefore more rigid, less likely to vibrate — and cuts more smoothly.
7. **Quieter Running** — Fewer teeth makes saw practically noiseless when running true.
8. **Blade Does Not Crack** — blades are made of special Vanadium Steel. In addition — controlling of cut prevents overloading of teeth, a common cause of blade cracking.

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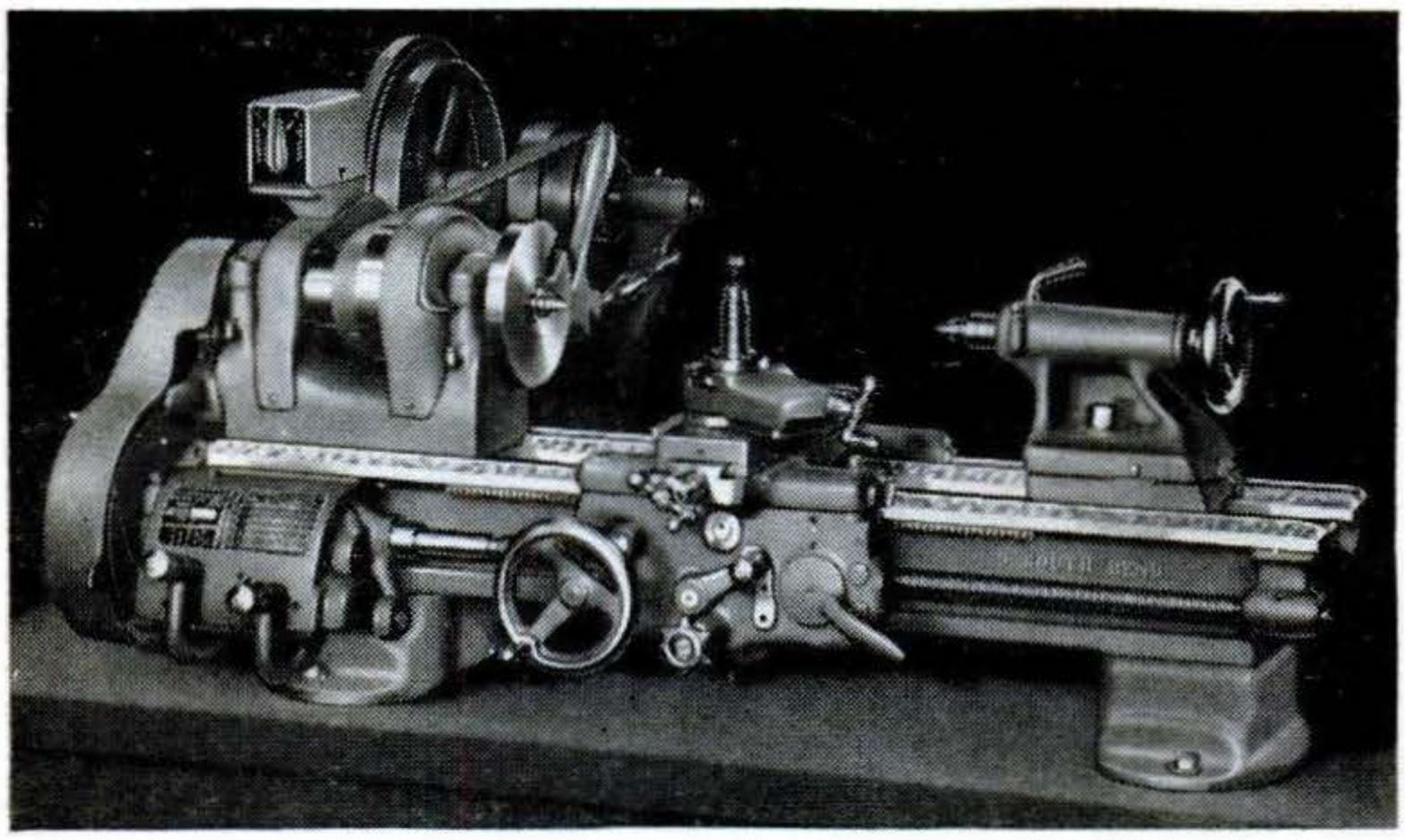

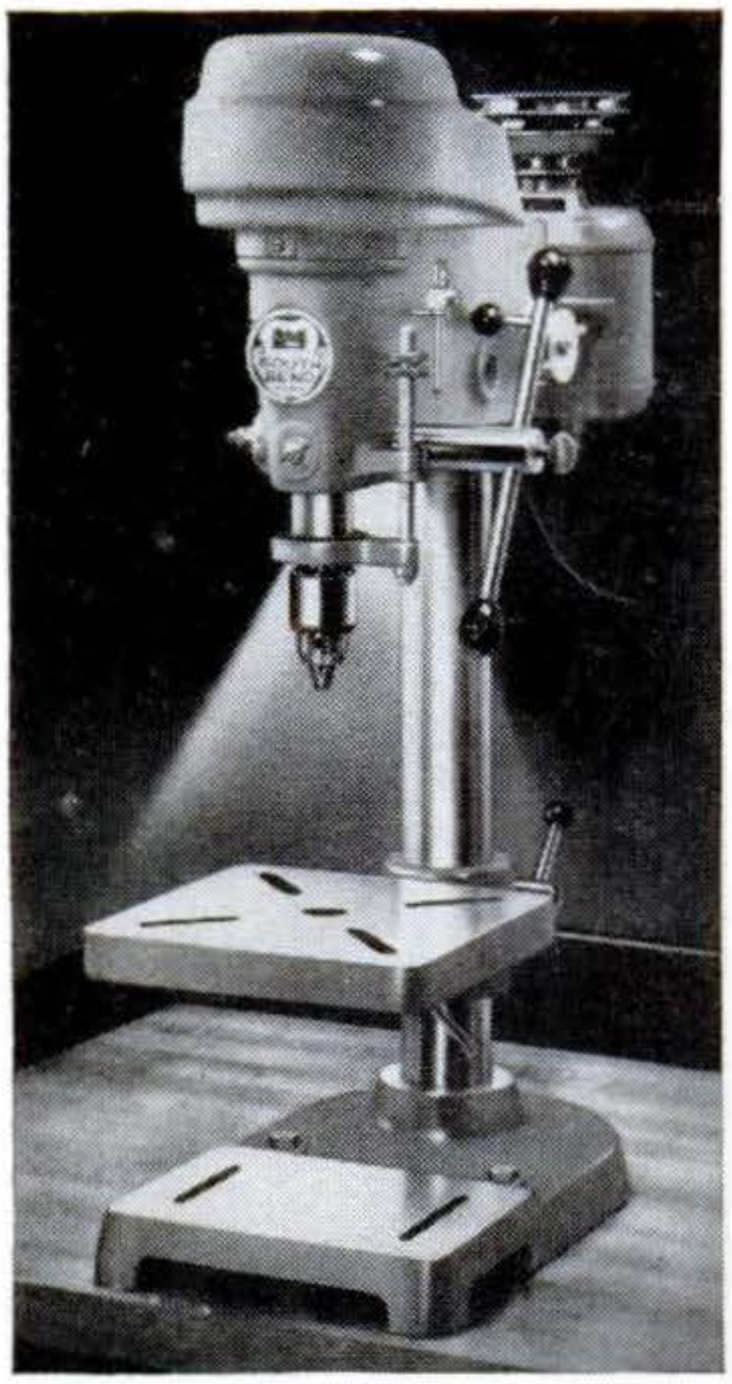

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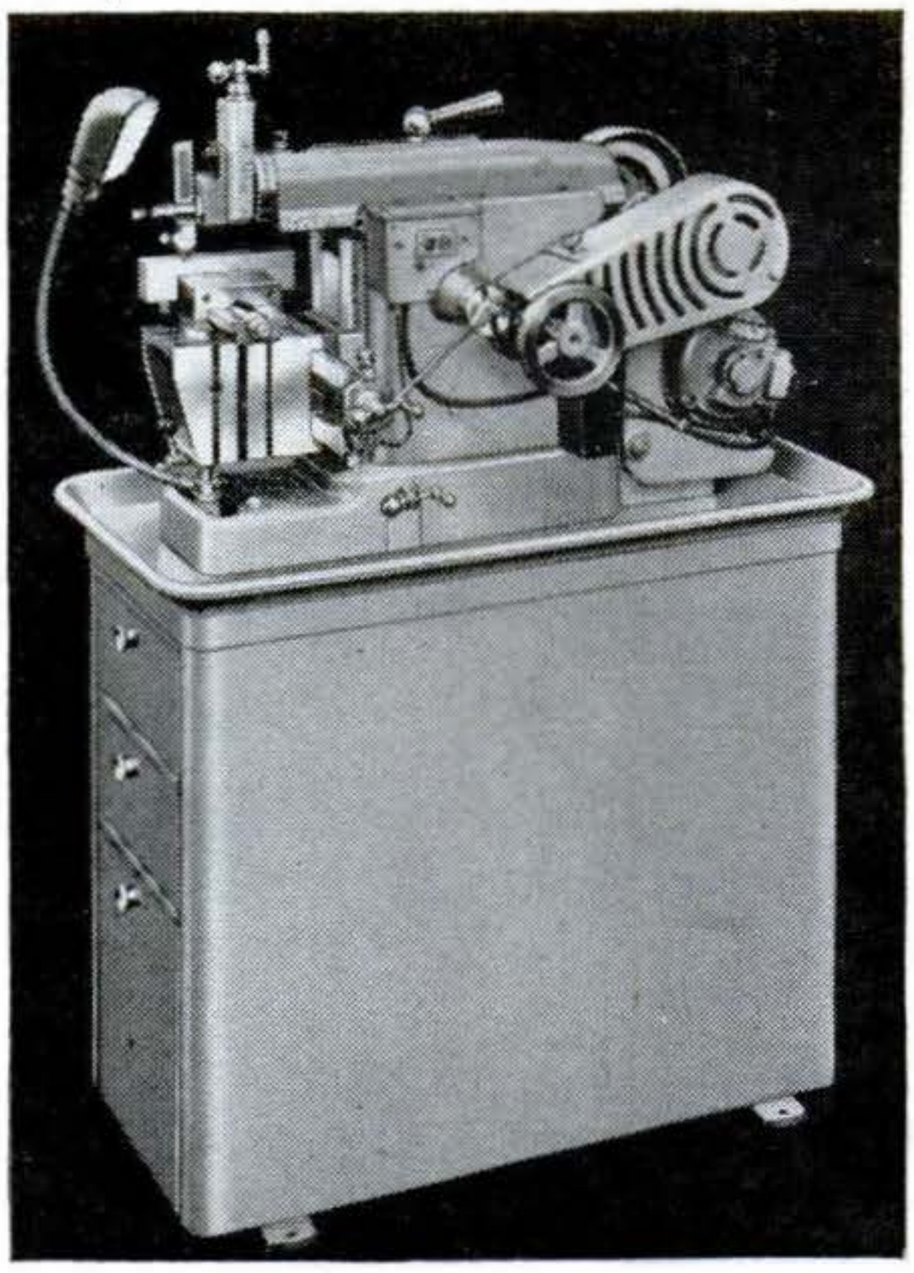

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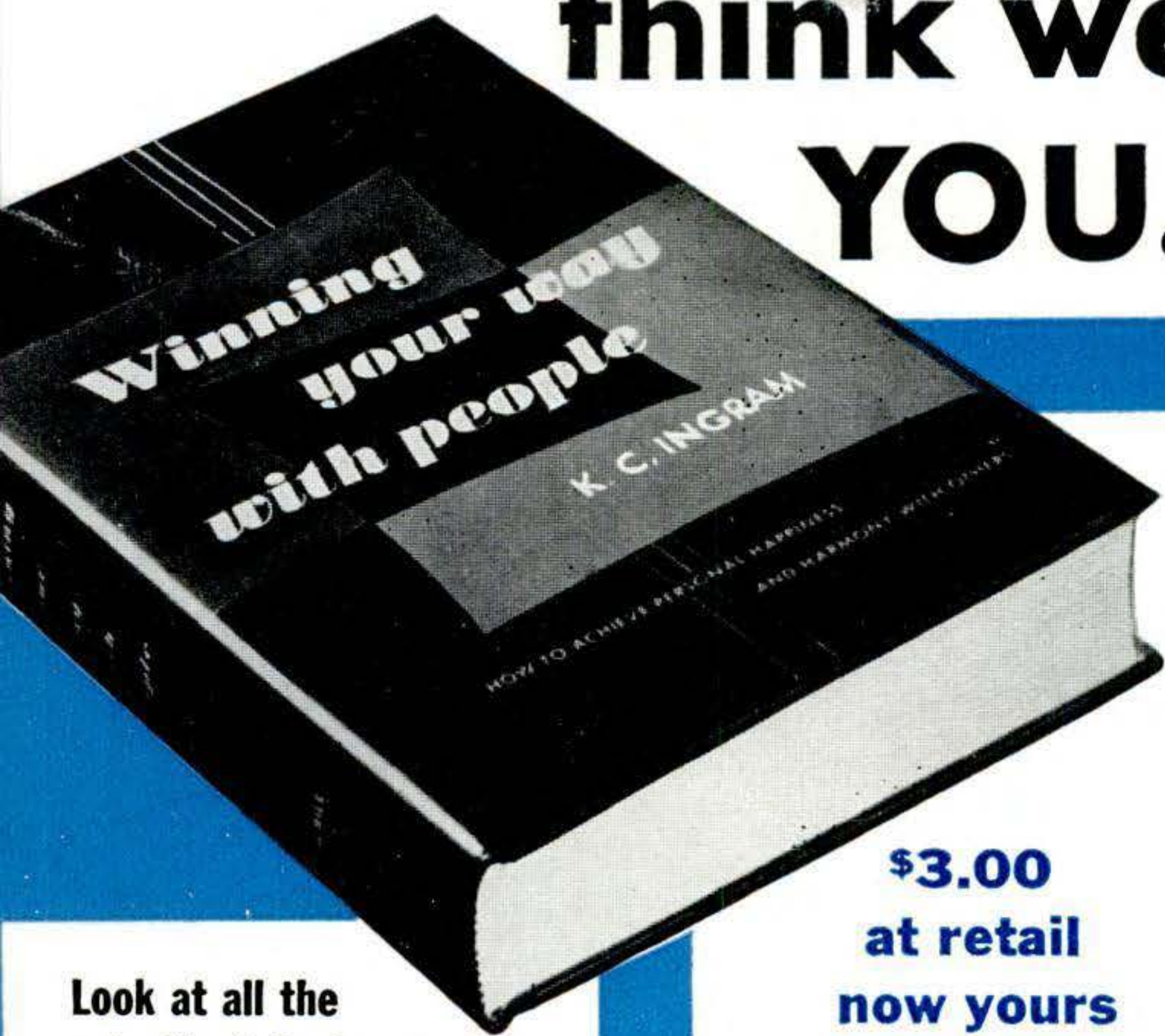

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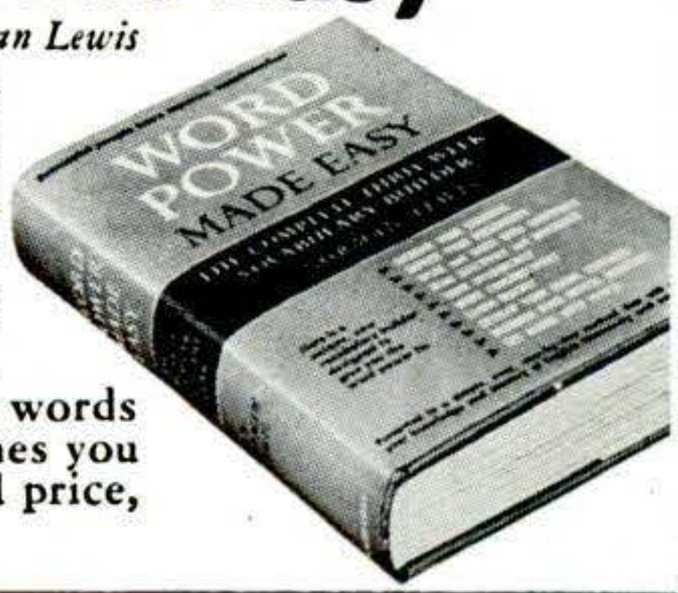

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